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<p>This study was performed to show a more efficient/effective means of scheduling surgeries at Madigan Army Medical Center. The concept of a surgery scheduling process using predictive data should be disseminated throughout the military health care system. This systematic approach to operating room scheduling management has a demonstrated potential to increase utilization, decrease cancellations, improve staff efficiency and increase patient satisfaction.</p>				
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AN ANALYSIS OF THE
SURGERY SCHEDULING PROCESS
AT MADIGAN ARMY MEDICAL CENTER

A Graduate Research Project
Submitted to the Faculty of
Baylor University
In Partial Fulfillment of the
Requirements for the Degree
of
Master of Health Administration

by

Major Ethan J. Stansbury, MS

29 July 1986

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I. INTRODUCTION

Background Description

Madigan Army Medical Center (MAMC) is a 520 bed tertiary care, teaching hospital. The Center is currently operating 367 beds, providing comprehensive inpatient and outpatient care to surgical, medical and psychiatric patients. As a regional medical center, Madigan is accessible to 180,000 eligible beneficiaries residing within five states: Washington, Oregon, Idaho, Montana, and Alaska. Over 18,000 inpatients are cared for at MAMC during the year. Of these, approximately 40 percent are surgery patients. In fiscal year 1985, the Madigan Department of Surgery medical staff performed 7,068 surgical operations.¹ This volume of surgery is achieved through dedicated teamwork of surgeons, anesthesiologists, nursing service personnel and administrative personnel. Surgery is performed on active duty military and their dependents, retirees and their dependents, and civilian emergencies.

A critical element in accomplishment of elective surgery at MAMC is the scheduling of the cases.

"Scheduling is the determination of when or in what order individual tasks of an already-selected set of jobs are to be performed. It involves allocating available resources to specific jobs at definite points in time or in a definite sequence."²

This is a complex process which involves the operating room (OR) nursing staff, anesthesia and surgery medical staff personnel and numerous services within the Center. The OR has utilized an automated "OR Registry" for the past year to gather surgical caseload data. However, this system has not been used to establish predictive information which can assist in the scheduling of cases for the operating suite.³

Unfortunately, there are many cancellations of surgical cases on the day preceding the scheduled surgery or the day of the scheduled surgery at Madigan.⁴ This is, in part, due to a less than optimal scheduling system at MAMC. As a result, there are undue hardships placed on patients, some who travel long distances to obtain their care. Additionally, staff utilization of the operating room is sub-optimal because of these cancellations. An analysis of the scheduling process of cases should identify the causes of surgery cancellations and provide insight to establish a more predictive surgery scheduling process at Madigan Army Medical Center.

Problem Statement

A study to determine the most effective scheduling process for surgical cases at Madigan Army Medical Center.

Objectives

1. Describe the current surgery scheduling procedures published in the center's regulations and/or Standing Operating Procedures.

2. Determine the actual OR utilization rates (minutes of OR time actually used divided by the amount of OR time available) of each operating room and the overall utilization rate at MAMC.

3. Determine which surgical cases are actually being performed at MAMC and the average time duration of each procedure.

4. Determine the causes of surgical cancellations.

5. Develop a more efficient scheduling system for surgical cases performed at MAMC.

6. Conduct a pilot study in May of 1986 to measure the effectiveness of the proposed scheduling system.

Criteria

1. There will be less than a 10% deviation between those cases scheduled for surgery and those actually performed.

2. The OR utilization rates will meet or exceed 80% overall.

3. Each surgical service will have a cancellation rate of the scheduled surgical procedures which is 10% or less.

4. The scheduling system will use the established predictive average case duration times and will match available time with the patient workload requirement. If time requirements exceed available time, caseload will be adjusted to ensure that available time is not exceeded.

Assumptions

1. The surgical workload during the study periods is representative of the normal workload expected at MAMC.

2. The retrospective data gathered are reliable.
3. OR utilization will never reach 100 percent.
4. Some OR time delays and cancellations of surgical procedures are unavoidable.

Limitations

1. Emergency surgeries will disrupt schedules.
2. The average length of time for each procedure analyzed will be determined from cases which have only one surgical procedure performed.
3. The time required by each surgeon to perform generically identical cases on different patients may vary due to the acuity of the patient.
4. The predictive data used to establish the surgery scheduling process will be based on retrospective data obtained from actual times required by the OR nursing staff, anesthesiologists and surgeons to perform specific cases. Because the center is a tertiary care teaching hospital, many cases are performed infrequently and statistical averages of these cases are difficult to determine.

Literature Review

Cost containment in the hospital industry is discussed frequently by economists, hospital administrators, and consumers of health care services. Within the hospital, the surgical suite is a critically important area of concern for containing costs.⁵ The high expense of staffing, equipping and maintaining an operating suite necessitates the effective and efficient management of resources within that area.

In the healthcare industry today, most organizations are trying to find ways, not only to contain costs, but also to reduce costs where possible.⁶ The primary reasons to focus on the operating room as a potential cost savings arena is the fact of poor utilization of the surgical capabilities of many hospitals nationwide.⁷ Within the past ten years, many authors have addressed the issue of operating room utilization. According to Dr. McQuarrie, the average utilization of operating rooms ranges from 40-60 percent.⁸ He states that the norms of utilization should routinely be above 60 percent, with peaks exceeding 75 percent.⁹ Because of the high costs associated with the OR and the relatively low utilization rates, the surgical suite offers many opportunities for reducing costs suggests Dr. McQuarrie. Effective establishment of management systems can reduce inefficiencies found within operating rooms. Donald Bridenbaugh, M.D., discusses the fact that surgical suites "account for approximately 10 percent of all hospital expenditures and are the fifth most expensive hospital department to run."¹⁰

The operating room is an expensive and complex part of hospital services. Yet, sub-optimal utilization of the surgical suite is commonplace.¹¹ Poor OR utilization is attributed to many causes. Studies at St. Barnabas Medical Center in New Jersey have shown that some of the most common reasons are: longer than expected cases, tardy surgeons, OR suite not properly readied, late arrival of the patient, emergency cases and additional procedures being added to the schedule.¹²

Under the best of circumstances, according to Dr. Bridenbaugh of Seattle, each patient would be operated on early in the morning, after a good night's sleep, with properly timed preoperative medication and without extra time for anxiety levels to rise while awaiting his or her surgery. The OR would be available and properly staffed with appropriate nursing personnel. All of the correct medical materiel would be present. Additionally, the anesthesiologist and surgeon(s) would be in the operating room at the appointed times.¹³ This ideal scenario does not always come to fruition in today's milieu of hospital operations. However, a systematic approach to managing operating room utilization can attribute to increased patient, physician and staff satisfaction.¹⁴

The first step to good OR utilization is to have a realistic surgery schedule.^{15,16,17} When a mismanaged or ineffective scheduling system is in place, the schedule is not followed, operations are cancelled or new cases added as an afterthought. Patients, nursing staff, anesthesiologists, surgeons and hospital administrators are angered, disappointed and often harbor resentment which fosters deterioration in the effective performance of the hospital staff and negative attitudes about the hospital. How well the surgery schedule is managed will help determine the effectiveness of operating room utilization.¹⁸

The multifactorial dynamics of the operating room make it impossible to reach 100% utilization of its capabilities.^{19,20} Gutman and Hejna view the OR as a "microcosm of a large and complex organization affecting and affected by the people,

resources, budget and environment in which it exists."²¹ Literature suggests that the utilization goal which seems to be most attainable is 80 percent.^{22,23} Efficient scheduling of cases in the operating room can promote specific, intense utilization of expensive resources. Retrospective data must be analyzed at specific time intervals to facilitate accurate assessment, planning and accountability of workload and utilization within the surgical suite.²⁴ This information can help to provide positive identification of specific areas of sub-optimal performance and make solutions or avoidance easier to achieve.

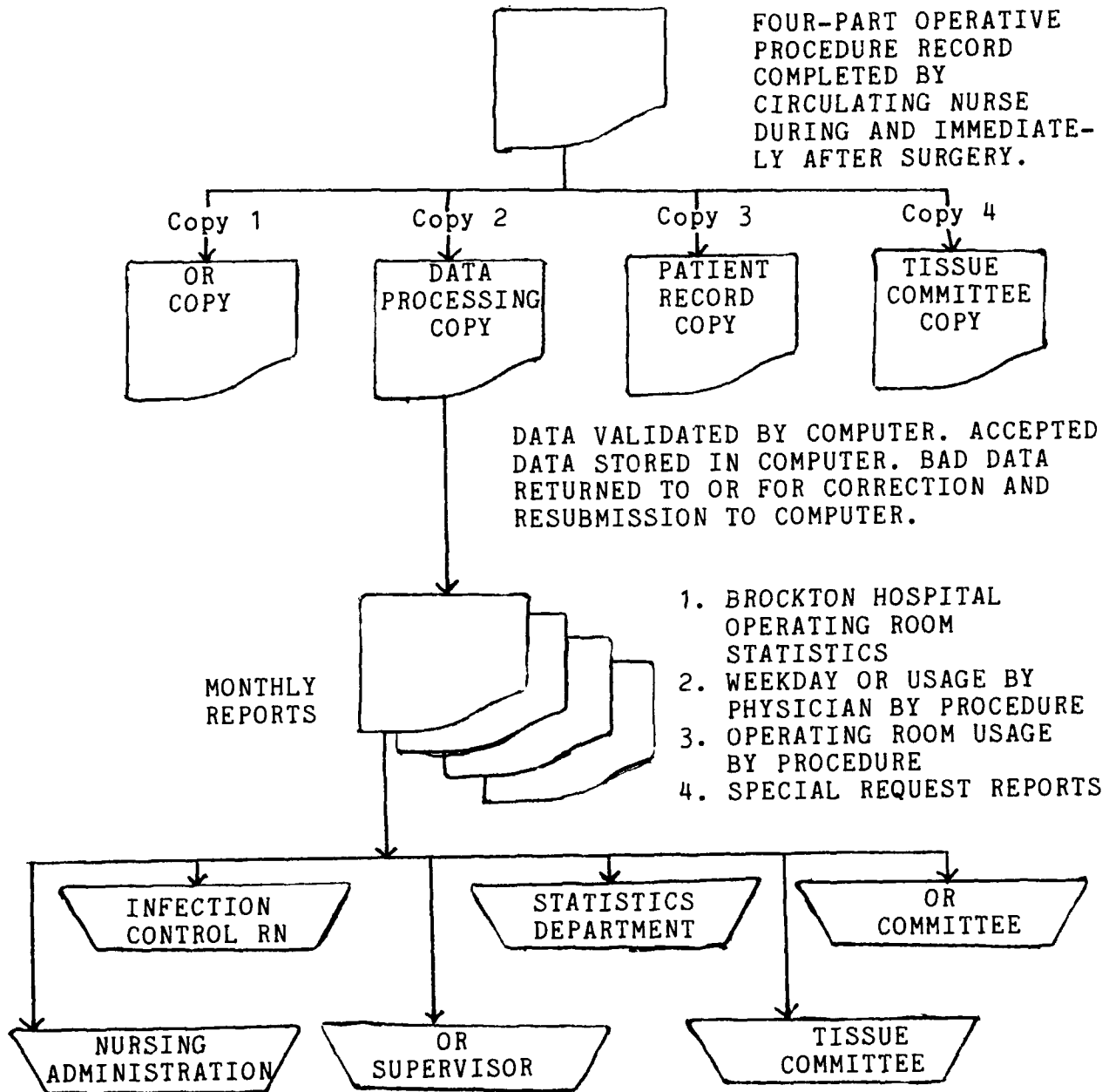
Several articles show different approaches to establishing an effective surgery scheduling system. One such functional process is outlined in the winter issue of Health Care Management Review. The article suggests that there are eight crucial elements which must be in place for optimal management and utilization of the surgical suite.²⁵ These components are (1) clear line of authority to make broad spectrum management decisions, (2) comprehensive set of OR policies and procedures must be in place, (3) a functional operating room committee in place, (4) an accurate, objective and timely data base established, (5) OR utilization and productivity goals delineated and communicated, (6) an established system for scheduling cases in the OR, (7) effective use of staff, and (8) management by exception for some OR programs.

Key to establishing an effective data base to improve OR scheduling is having an efficient mechanism by which data are

collected and stored. Stephen L. Priest and others suggest that a computerized OR log system is necessary for solving the problems of gathering OR data.²⁶ The OR log can make use of accurate and complete data for audits, case scheduling and other planning decisions. Priest suggests that once the initial review of computer report formats are reviewed and approved by an OR committee, data collection can begin.²⁷ Normally, a circulating nurse collects pertinent data regarding each ongoing case in the operating room. Data, such as start and stop times of anesthesia, surgery, operating room nursing personnel, delay reasons and cancellation causes are gathered for each case. These data are entered into the OR log by the surgical suite medical clerk or secretary. Once data are in the log, output reports can be generated on a weekly, monthly or as needed basis.

A flow chart of a typical system is shown at Figure 1.²⁸ This information provides a list of cases scheduled, emergency cases, operating room utilization, staffing patterns and other information. The OR usage by surgeon report presents cases performed and the average time per procedure. Information such as this can be used to more accurately estimate procedure time by physicians for future scheduling requirements. This process has led to "much more realistic utilization of the OR facility and for fewer incidents in which the surgeon is delayed or asked to begin a case earlier than expected."²⁹ Priest states that this automated system effectively removes incomplete and inaccurate data and improves the overall approach to operating room management.³⁰

FIGURE 1
OR LOG AND DATA SYSTEM



Source: Hospitals, June 1980, page 81.

With an automated system, other management indicators are now available to the OR committee or director. The capability to monitor what service or physician may have an unusually high number of emergency cases is one example. Another is the ability to determine average case duration times to allow for a more accurate estimate of what amount of time should be allocated to the case if the surgeon's prior record of performance is not known at the institution.³¹ Dr. Hancock, a professor at the University of Michigan, states that the automated operating room log reduces the time required to record, correct, and gather important statistical data. By using this type of system, the institution would have a higher OR utilization rate and surgeons would have fewer surgery cancellations and a more dependable schedule.³² The system produces a myriad of information which allows the "surgical team" in the operating suite to better plan for each surgical case and each day.

Buckley, Lande and Moll implemented an OR information system at the University of Minnesota Hospital in the early 1970's.³³ This system provided periodic information on room activity, caseload distribution among surgeons and services, OR utilization, elective versus emergency case distribution, and reasons for cancelled surgery.³⁴ This approach to operating room management has led to improved utilization, efficiency and effectiveness in the surgical suite and improved care for the patient.³⁵

Research Methodology

Initially, an orientation to MAMC's Department of Surgery elective surgery scheduling process was conducted. This orientation was accomplished by reading the center's regulations, to include Surgery, Anesthesia, and Nursing Service regulations regarding the OR scheduling process. Standing Operating Procedures of applicable surgical services were reviewed. Interviews with the Chiefs of the Department of Surgery, Anesthesia and Operative Service, and the Operating Room Nursing Section were conducted to establish the perceptions of the scheduling process at Madigan. Questions were oriented towards areas such as (1) satisfaction with the process, (2) improvement in scheduling since receiving the automated OR registry, (3) administration problems, (4) clinical problems, (5) areas that can be improved upon, (6) and the informative data which will best present a better understanding of the OR scheduling/utilization process. The working/organizational relationships were ascertained from the interviews and are shown in Figure 2.

Next, flow diagrams were established to depict each step of the surgery scheduling process in each surgical service (Tables 1-11). Services, positions and specific individuals are identified at each step of the process. Externalities which may alter the process were discussed with staff surgeons, residents, and other appropriate personnel.

FIGURE 2

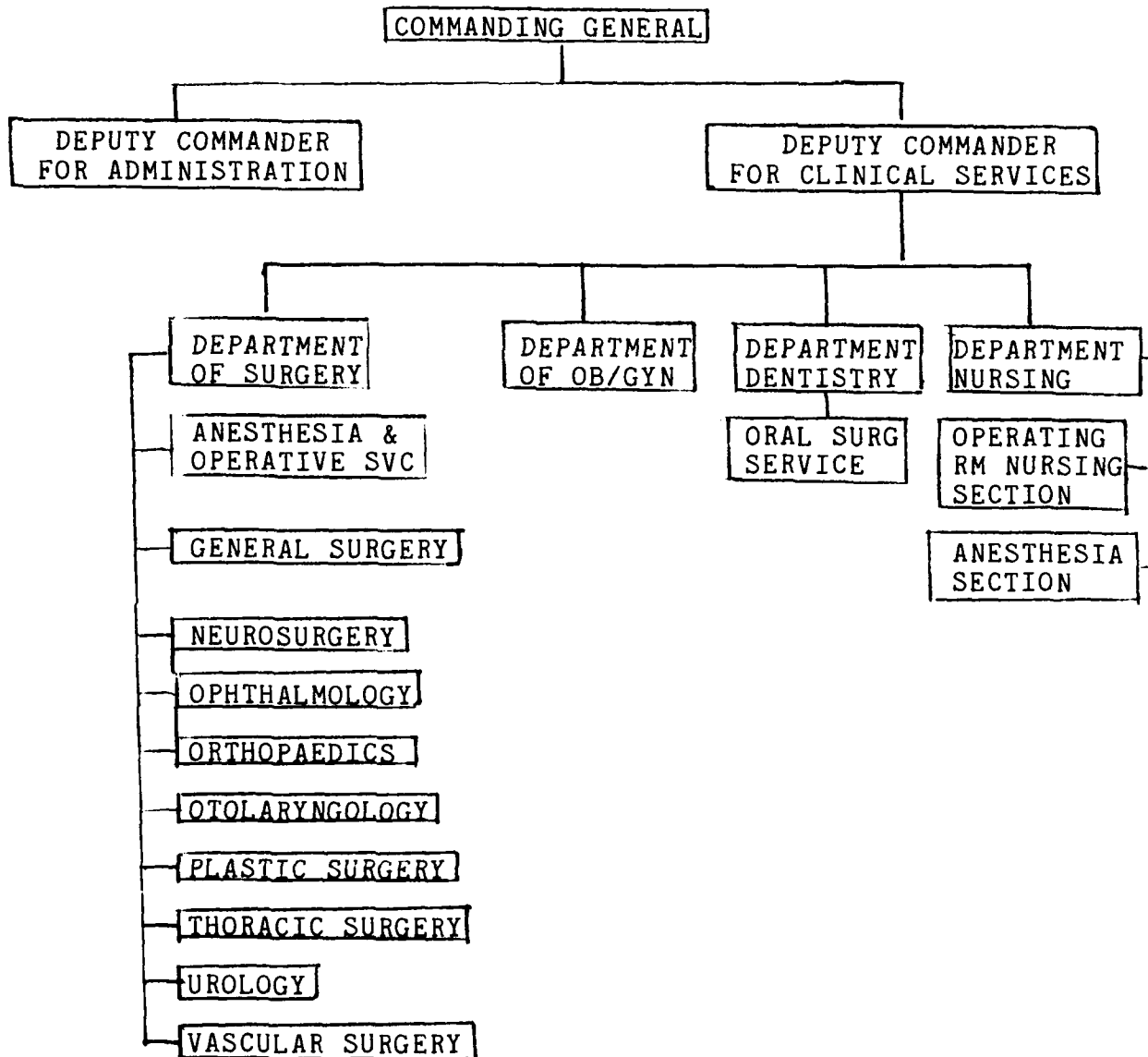
ORGANIZATIONAL STRUCTURE OF SURGICAL
SUITE RELATIONSHIPS

TABLE 1

GENERAL SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
PREPARES A SURGERY CARD FOR THE PATIENT

SURGERY CARD PRESENTED TO CHIEF RESIDENT
FOR REVIEW

CHIEF RESIDENT SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

ON THE WEEK PRIOR TO THE SCHEDULED SURGERY,
THE CHIEF RESIDENT ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

THE SERVICE SECRETARY WILL SEND SURGERY
NOTIFICATIONS TO THE PATIENT

ON THURSDAY PRIOR TO THE WEEK OF SCHEDULED SURGERY
THE PATIENT WILL BE SEEN AT THE HOSPITAL TO RECEIVE PHYSICIAN
CLEARANCE FOR THE PROCEDURE AND TO OBTAIN CURRENT
LAB WORK AND RADIOLOGY STUDIES AS REQUIRED

IF THE PATIENT IS CLEARED FOR SURGERY, HE/SHE WILL BE TOLD WHEN
TO REPORT FOR ADMITTANCE TO THE HOSPITAL

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE PRIMARY
SURGEON WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 2

UROLOGY SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
TENTATIVELY SCHEDULES SURGERY FOR THE
PATIENT AFTER STAFF REVIEW

PATIENT SENT TO SERVICE SECRETARY TO
RECEIVE PREOPERATIVE ADMINISTRATIVE
INSTRUCTIONS

SEVEN DAYS PRIOR TO THE DATE OF SCHEDULED SURGERY,
A DETAILED PREOPERATIVE CONFERENCE ESTABLISHES THE
OPERATIVE SCHEDULE FOR THAT DATE

THE SERVICE SECRETARY WILL THEN
NOTIFY THE PATIENT

ON THE DAY PRIOR TO THE SCHEDULED SURGERY
THE PATIENT WILL BE ADMITTED TO RECEIVE PHYSICIAN
CLEARANCE FOR THE PROCEDURE AND TO OBTAIN CURRENT
LAB WORK AND RADIOLOGY STUDIES AS REQUIRED

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE PRIMARY
SURGEON WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO
THE FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES TO
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 3
GYNECOLOGY SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
PATIENT IS SEEN BY A STAFF SURGEON FOR REVIEW

RESIDENT SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

PATIENT SENT TO WARD CLERK TO RECEIVE
PREOPERATIVE ADMINISTRATIVE INSTRUCTIONS

ON THE WEEK PRIOR TO THE SCHEDULED SURGERY,
THE CHIEF RESIDENT ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

ON THURSDAY PRIOR TO THE WEEK OF SCHEDULED SURGERY
THE PATIENT WILL BE PREADMITTED TO RECEIVE PHYSICIAN
CLEARANCE FOR THE PROCEDURE AND TO OBTAIN CURRENT
LAB WORK AND RADIOLOGY STUDIES AS REQUIRED

THE PATIENT WILL REPORT FOR ADMITTANCE TO THE HOSPITAL
THE DAY PRIOR TO SURGURY

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE CHIEF RESIDENT
WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO THE FOLLOWING DAY'S
SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 4

VASCULAR SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
PREPARES A SURGERY CARD FOR THE PATIENT

SURGERY CARD PRESENTED TO CHIEF RESIDENT
FOR REVIEW

CHIEF RESIDENT SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

ON THE WEEK PRIOR TO THE SCHEDULED SURGERY,
THE CHIEF RESIDENT ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

THE SERVICE SECRETARY WILL SEND SURGERY
NOTIFICATIONS TO THE PATIENT

ON THURSDAY PRIOR TO THE WEEK OF SCHEDULED SURGERY
THE PATIENT WILL BE PREADMITTED TO RECEIVE PHYSICIAN
CLEARANCE FOR THE PROCEDURE AND TO OBTAIN CURRENT
LAB WORK AND RADIOLOGY STUDIES AS REQUIRED

IF THE PATIENT IS CLEARED FOR SURGERY, HE/SHE WILL BE TOLD WHEN
TO REPORT FOR ADMITTANCE TO THE HOSPITAL

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE PRIMARY
SURGEON WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO THE FOLLOWING DAY'S
SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 5

OTOLARYNGOLOGY SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
PREPARES A SURGERY FILE FOR THE PATIENT

SURGERY FILE PRESENTED TO SENIOR RESIDENT/
STAFF SURGEON FOR REVIEW

SENIOR RESIDENT/STAFF SURGEON APPROVES THE
PATIENT FOR SURGERY

THE RESIDENT WILL TELEPHONICALLY NOTIFY
THE PATIENT OF THE SURGERY DATE

ON THE TUESDAY OF THE WEEK PRIOR TO THE WEEK
OF SCHEDULED SURGERIES, THE PREOPERATIVE
CONFERENCE WILL DISCUSS THE CASES IN DETAIL

DURING THE WEEK PRIOR TO THE WEEK OF SCHEDULED SURGERY
THE PATIENT WILL BE CLEARED FOR THE
PROCEDURE AND WILL OBTAIN CURRENT
LAB WORK AND COMPLETION OF RADIOLOGY STUDIES AS REQUIRED

IF THE PATIENT IS CLEARED FOR SURGERY, HE/SHE WILL BE TOLD WHEN
TO REPORT FOR ADMITTANCE TO THE HOSPITAL

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE PRIMARY
SURGEON WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 6

THORACIC SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
PREPARES A SURGERY CARD FOR THE PATIENT

SURGERY CARD PRESENTED TO SENIOR RESIDENT
FOR REVIEW

CHIEF RESIDENT SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

ON THE WEEK PRIOR TO THE SCHEDULE SURGERY,
THE CHIEF RESIDENT ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

THE SERVICE SECRETARY WILL SEND SURGERY
NOTIFICATIONS TO THE PATIENT

ON THURSDAY PRIOR TO THE WEEK OF SCHEDULED SURGERY
THE PATIENT WILL BE PREADMITTED TO RECEIVE PHYSICIAN
CLEARANCE FOR THE PROCEDURE AND TO OBTAIN CURRENT
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OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 7

ORTHOPAEDIC SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS AND
PATIENT IS SEEN BY A STAFF SURGEON FOR REVIEW

PHYSICIAN SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

PATIENT SENT TO SERVICE SECRETARY TO RECEIVE
PREOPERATIVE ADMINISTRATIVE INSTRUCTIONS

ON THE WEEK PRIOR TO THE SCHEDULE SURGERY,
THE CHIEF RESIDENT ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

THE PATIENT WILL REPORT FOR ADMITTANCE TO THE HOSPITAL
THE DAY PRIOR TO SURGERY

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE CHIEF
RESIDENT WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 8

NEUROSURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS

NEUROSURGEON SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

ON THE DAY PRIOR TO THE SCHEDULED SURGERY,
THE PATIENT WILL BE ADMITTED TO THE WARD FOR
THE PROCEDURE AND TO OBTAIN CURRENT LAB WORK AND RADIOLOGY
STUDIES AS REQUIRED

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE
NEUROSURGERY MEDICAL CLERK WILL SUBMIT AN OPERATIVE REQUEST
TO ANESTHESIA AND OPERATIVE SERVICES FOR PLACEMENT
ONTO THE FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 9
OPHTHALMOLOGY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS
AND SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

PATIENT IS GIVEN ADMINISTRATIVE
PREOPERATIVE INSTRUCTIONS

THE SERVICE SECRETARY WILL SEND SURGERY
NOTIFICATIONS TO THE PATIENT

ON THE MONDAY OF THE WEEK OF SCHEDULED SURGERY, THE
PATIENT WILL OBTAIN PREADMISSION LAB WORK
AND RADIOLOGY STUDIES AS REQUIRED

IF THE PATIENT IS CLEARED FOR SURGERY, HE/SHE WILL BE TOLD
TO REPORT FOR ADMITTANCE TO THE HOSPITAL
ON THE DAY PRIOR TO SURGERY

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE PRIMARY
SURGEON WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA
AND OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 10
PLASTIC SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY PHYSICIAN

PHYSICIAN ESTABLISHES THE DIAGNOSIS
AND SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

ON THE WEEK PRIOR TO THE SCHEDULED SURGERY, THE
SERVICE MEDICAL CLERK ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

ON THE DAY PRIOR TO THE SCHEDULED SURGERY THE
PATIENT WILL BE ADMITTED FOR THE
PROCEDURE AND WILL OBTAIN CURRENT LAB WORK AND
RADIOLOGY STUDIES AS REQUIRED

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE SERVICE
MEDICAL CLERK WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA
AND OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

TABLE 11

ORAL SURGERY SCHEDULING PROCESS

PATIENT SEEN IN CLINIC BY A STAFF PHYSICIAN
WHO ASSIGNS THE PATIENT TO A RESIDENT

RESIDENT ESTABLISHES THE DIAGNOSIS AND
PREPARES A SURGERY CARD FOR THE PATIENT

SURGERY CARD PRESENTED TO CHIEF RESIDENT
AND THEN TO A STAFF PHYSICIAN FOR REVIEW

CHIEF RESIDENT SCHEDULES THE PATIENT FOR
SURGERY ON A MASTER LONG RANGE SCHEDULE

A DENTAL ASSISTANT WILL GIVE THE SCHEDULED
SURGERY DATE TO THE PATIENT

ON THE WEEK PRIOR TO THE SCHEDULED SURGERY,
THE CHIEF RESIDENT ESTABLISHES A PREOPERATIVE
SCHEDULE FOR THE COMING WEEK

TWO DAYS PRIOR TO THE DAY OF SCHEDULED SURGERY
THE PATIENT WILL BE PREADMITTED TO RECEIVE PHYSICIAN
CLEARANCE FOR THE PROCEDURE AND TO OBTAIN CURRENT
LAB WORK AND RADIOLOGY STUDIES AS REQUIRED

IF THE PATIENT IS CLEARED FOR SURGERY, HE/SHE WILL BE TOLD WHEN
TO REPORT FOR ADMITTANCE TO THE HOSPITAL

ON THE DAY PRECEDING THE SCHEDULED SURGERY, THE PRIMARY
SURGEON WILL SUBMIT AN OPERATIVE REQUEST TO ANESTHESIA AND
OPERATIVE SERVICES FOR PLACEMENT ONTO THE
FOLLOWING DAY'S SCHEDULE

THE ANESTHESIA AND OPERATIVE SERVICE WILL SCHEDULE THE CASES FOR
THE FOLLOWING DAY AND PRINT AN OPERATING ROOM SCHEDULE WITH
ESTABLISHED ROOM ASSIGNMENTS AND CASE SEQUENCE FOR EACH CASE

In consultation with the OR Staff Development Coordinator, a suitable time period was determined to review MAMC's actual surgery workload and utilization.³⁶ This actual measure of operating room activity determined what surgeries were being performed and the actual utilization of the surgical suites. Other information gathered were the number of emergency surgeries and cancellations of elective surgeries that occurred during the study period. Average case duration times and the surgeon's activity profile were also determined. A four month study period from June through September 1985 was used to gather the retrospective data. This information was taken from data annotated on the Operation Request and Worksheet, DA Form 4107 (Appendix B) which is recorded in the automated OR registry at Madigan.³⁷

During the study, a determination of exactly which types of surgical cases that were being performed was accomplished. Only single procedure cases were reviewed in order to isolate time parameters of the different segments of the case. This information is determined from the outcome of the case and described on the Operative Request and Worksheet by the anesthesiologist using the Physician's Current Procedural Terminology.³⁸ This book is a listing of descriptive terms and corresponding codes by which medical services and procedures performed by physicians can be reported. The reason for these codes is to provide a standard language which accurately describes services and procedures which can be used for reliable nationwide communication between physicians, patients and third parties. Examples of cases identified are shown in Appendix C.

Next, the actual daily OR utilization was determined and is shown in Appendix D. Also, the number and types of emergency surgeries (Appendix E) and the surgery cancellations (Appendix F) were analyzed. The surgical workload which was used to determine these data came from an analysis of workload between 0700 to 1530 hours, Monday through Friday.

The determination of OR utilization provides an overview of how active Madigan's operating room actually is. An identification of how many emergency surgeries occur on a daily basis shows how disruptive emergencies can be on the planned, elective surgery schedule. After determining utilization, emergency surgeries and isolating the resulting cancellations of cases, an analysis of variance was performed to determine if there were any statistically significant differences between the days of week over the study period for each major area reviewed. Additionally, a statistical determination of the correlation between utilization, emergency surgeries and cancellations was accomplished to see what effect one outcome might have had on the others.

The last and most critical part of the research centered around determining the average case duration times for each segment of the operations. This time includes OR nursing staff room preparation prior to and after the surgery, preoperative and postoperative anesthesia time, surgical preparation time and the actual surgeon time required to perform the operation. During each case, an OR "circulating" nurse annotates the Operation Request and Worksheet with each time that one of the events

described above actually starts and when it stops. This information is then input to the OR registry by the medical secretary. Report formats were written to generate necessary information from the automated OR registry for the research. Appendices G through N show the formats that were written and examples of data that were abstracted from the registry.

The primary operating surgeon was also noted in order to develop a "surgeon's activity profile" regarding the types of procedures he or she conducts, and the length of time each procedure takes. An example of this data is shown in Appendix O. The data can be used to more adequately forecast procedure time requirements by surgeon in order to optimize daily surgery scheduling.

Once the elective cases are scheduled and the operation request and worksheet is submitted from the services to Anesthesia and Operative Services, an OR schedule is prepared by the medical secretary. An example of the daily schedule is shown at Appendix P. During the four month study, the scheduled surgeries were determined by reviewing the OR daily schedule. This information reflects what surgeons/services are referring patients for surgery. The data were compared with the actual performed surgeries (determined by completed operation requests and worksheets) to see what the cancellation rates from originally scheduled cases actually were.

When a cancellation occurs, the operation request form utilized by the OR will be annotated to show why the surgery was changed from when it was originally scheduled.

Once all of the above described data had been gathered, the following information was established: (1) The average utilization rate of each OR suite by day of the week and the institutional total OR utilization, (2) The emergency surgeries by day of the week and total numbers of emergency cases, (3) The average number of surgeries which are canceled each day of the week and the cause for cancellation, (4) The cancellation rates of surgeries by service, (5) The average time certain types of cases take to perform by each surgical team member in the surgical suite milieu.

The Chief of the Department of Surgery, approved the concept of a "pilot program" to run in May 1986.³⁹ The pilot program utilizes the above predictive information to determine the optimal surgery schedule on a daily basis. The Department of Surgery service chiefs or the senior surgery resident for the service were informed of the retrospective study results. They were provided with the average case duration times for each case analyzed and asked to use these statistically predictive average case times to establish their surgery schedules for the month of May. During the pilot program the same type of data that was originally gathered was again gathered and compared to the established criteria.

The reasons/causes for operating room utilization at Madigan can be determined by understanding the actual scheduling process at MAMC, by reviewing utilization rates, by determining emergency cases, by reviewing services cancellation rates, and by profiling average case duration times. Administrative policy changes may

lower a service's cancellation rate or improve the effectiveness of OR utilization. Shifting cases during the week may improve utilization efficiency. The profile of average case duration times allows the best possible forecasting of OR time requirements which will improve OR utilization rates and reduce untimely delays and/or cancellations. All of this information can be used to enhance the efficiency of MAMC's operating room scheduling process, which will improve the patient's satisfaction with the surgical encounter and improve the staff's satisfaction with the scheduling process.

FOOTNOTES

¹Interview with Kathy Sawyer, Statistics Analyst, Directorate of Patient Administration, Madigan Army Medical Center, Tacoma, Washington, 2 October 1985.

²Werner F. Daeschel, "General Hospital Scheduling," Hospital Administration 16 (Fall 1972): 35-36.

³Interview with Alfred S. Buck, Chief, Department of Surgery, Madigan Army Medical Center, Tacoma, Washington, 8 August 1985.

⁴Interviews with Jean M. Reeder, Operating Room Coordinator, Department of Nursing, Madigan Army Medical Center, Tacoma, Washington, 9, 20 August 1985.

⁵Steven R. Eastaugh, "Cost of Elective Surgery and Utilization of Ancillary Services in Teaching Hospitals," Health Services Research 14 (Winter 1979): 290.

⁶Barbara Fahey and Gloria Swanberg, "More Operating Rooms or Better Use of Resources?," Nursing Management 14 (May 1985): 16.

⁷Hospitals, "Practical tips on Cost Containment," Hospitals (August 16, 1980): 155.

⁸Donald F. McQuarrie, "Limits to Efficient Operating Room Scheduling," Archives of Surgery 116 (August 1981): 1065-1066.

⁹Ibid., p. 1065.

¹⁰L. Donald Bridenbaugh, "Operating Room Utilization and Care of the Surgical Patient," Bulletin of the American College of Surgeons 64 (November 1979): 11.

¹¹Kimberly Casey, Barbara Hackey and Seetharama Narasimhan, "Maximizing Resources - Efficient Scheduling of the OR," Association of Operating Room Nurses 39 (June 1984): 1174.

¹²Kanella T. Phillips, "Operating Room Utilization," Hospital Topics (March/April 1975): 44-45.

¹³Ibid., Bridenbaugh, pp. 11-12.

¹⁴Diana C. Wilson, "Efficient OR Management," Nursing Management 15 (May 1984): 38B.

¹⁵Michael Nathanson, "Computer-aided scheduling can put scalpel to costs of operating room," Modern Healthcare (May 1, 1984): 44.

¹⁶K. H. Hanson, "Computer Assisted Operating Room Scheduling," Journal of Medical Systems 6 (June 1982): 314.

¹⁷*Ibid.*, Bridenbaugh, pp. 11-12.

¹⁸*Ibid.*, Bridenbaugh, p. 12.

¹⁹*Ibid.*, McQuarrie, p. 1065.

²⁰*Ibid.*, Nathanson, pp. 44,46.

²¹Cheryl M. Gutmann and William F. Hejna, "The Management of Surgical Facilities in Hospitals," Health Care Management Review (Winter 1983): 52.

²²*Ibid.*, p. 54.

²³Hospitals, "Improving O.R. Utilization," Hospitals 49 (August 1,1975): 81.

²⁴*Ibid.*, Fahey and Swanberg, p. 17.

²⁵*Ibid.*, Gutmann and Hejna, pp. 52-55.

²⁶Stephen L. Priest and others, "Computerized O.R. Log System Has Many Uses," Hospitals (June 1, 1980): 79.

²⁷*Ibid.*, pp. 79-80.

²⁸*Ibid.*, p. 81.

²⁹*Ibid.*, p. 82.

³⁰*Ibid.*, p. 82.

³¹*Ibid.*, Hanson, p. 313.

³²*Ibid.*, Nathanson, p. 44.

³³Joseph J. Buckley, Marilyn A. Lande and Dennis B. Moll, "O.R. Information System Implemented," Hospitals 49 (January 1,1975): 55.

³⁴*Ibid.*

³⁵*Ibid.*, p. 60.

³⁶Ibid., Reeder.

³⁷Interview with Eileen Jamison, Medical Secretary,
Anesthesia and Operative Services, Madigan Army Medical Center,
Tacoma, Washington, 14 August 1985.

³⁸Ibid.

³⁹Ibid., Buck.

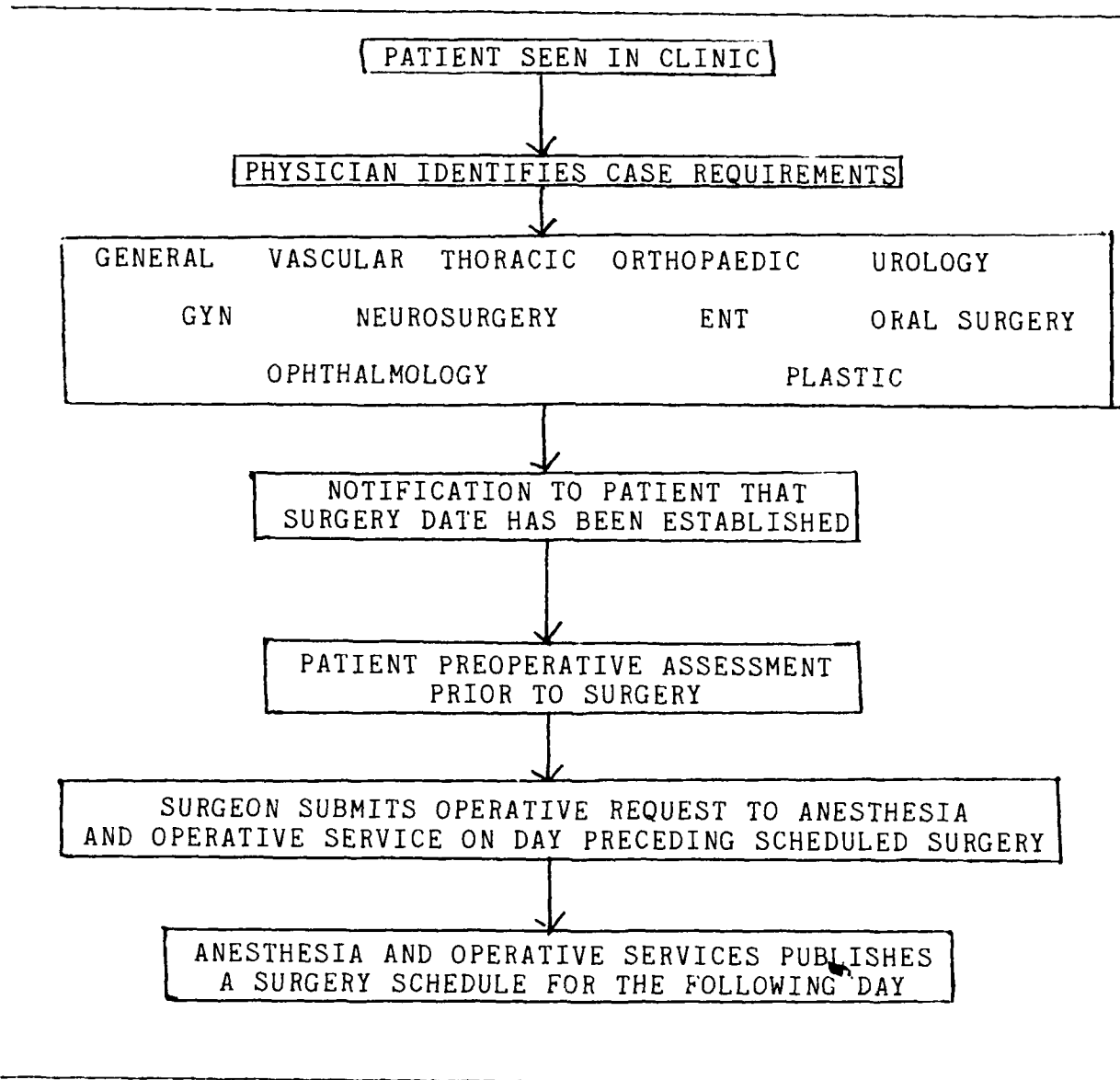
II. DISCUSSION

Current Scheduling Procedures

Madigan has eleven surgical services which can request operating room time to perform the necessary surgeries of the patient population supported. Each service has its own procedure to identify patients who need elective surgery and get the patient scheduled for the procedure. Patients needing emergency surgery may access the hospital through the emergency room, acute illness clinic or one of many other clinics/services. Management of emergency cases is accomplished "off-line" from the elective surgery scheduling process.¹

Although each service may schedule patients a little differently (see Tables 1-11) and have varying time backlogs to get its patients on the OR schedule, the basic process is the same (see Table 12). Initially, patients are seen in the surgery service clinic. These patients may have been followed in the clinic for an indefinite time period, referred from other clinics within the hospital or referred from other military or civilian hospitals or physicians to Madigan. Each service will have a physician assess the patient and establish the diagnosis. A tentative schedule will be established for performing the surgery. This time may be as soon as 1 week or as long as 6-8 weeks depending on the services' backlog of patients and the

TABLE 12
SURGERY SCHEDULING PROCESS



urgency of the case. Once a relatively firm date for surgery has been established, the patient will be notified to come to the hospital for preadmission screening. This entails a physician assessment and necessary laboratory work and radiology studies to be performed prior to surgery. The patient will be told when and to which ward to report. The Department of Surgery is allotted 145 beds of the 367 beds that are currently staffed at Madigan. The operative services bed distribution is shown in Table 13. In order for the service to properly schedule a new patient for surgery, there must be a bed available to the service for admission of the new patient to the center. This is a relatively new process which has improved the overall case management of each patient. Previously, all surgical patients entered the hospital through Ward 5 which was designated a preoperative ward. Once the surgery was performed, the patient would go to Ward 11

TABLE 13
OPERATIVE SERVICES BED DISTRIBUTION

WARD 5		WARD 11		WARD 13	
SERVICE	# BEDS	SERVICE	# BEDS	SERVICE	# BEDS
GYN	16	GEN/VASC	40	ORTHO	35
DENTAL	6	THORACIC	4	UROLOGY	14
EYE	5	ENT	12	NEURO-	
		PLASTIC	3	SURGERY	7
				PLASTIC	2

or 13 depending on which service was managing the case unless placement in one of the critical care units was indicated. The results of this process were that often cases would be cancelled because there was not a surgical bed available on Ward 11 or 13 to receive the patient.

On the day preceding the patient's scheduled surgery day, each service will submit the operation request to the Anesthesia and Operative Service by 1000 hours. The Chief of the Anesthesia and Operative Service and the Chief of the Anesthesia Nursing Section or their representatives will review the operation requests, which are commonly referred to as "buck slips", and establish room and case sequence assignments and staff assignments for each case. The daily OR schedule will then be published by the Anesthesia and Operative Service at 1400 hours for the surgery schedule of the following day.

Surgical Procedures Performed

The next step of the retrospective study was to determine what surgical procedures were performed at Madigan during the study period. All surgical cases were analyzed from 3 June - 27 September 1985 to determine overall OR utilization, volume of emergency cases and the total number of cases cancelled. Only single procedure cases were analyzed to determine average case duration times. Of the 1752 single procedure surgeries performed at MAMC, only 69 were performed five or more times during the study period. These cases accounted for 64 percent of the total caseload that occurred in the operating room. This caseload volume will be discussed further later in this paper.

Operating Room Utilization

To determine operating room utilization during the study period, a clearly defined measure had to be established. The policies of the operating room were reviewed to determine what hours the OR conducted "normal business." This normal operations time is that time during which the suites are fully staffed to manage scheduled elective cases. This time will also include the unscheduled emergency cases which any fully operating hospital with surgical capabilities could expect. Routine hours of operations were found to be from 0700 to 1530 hours daily, Monday through Friday. This gives 510 minutes of available room time for each operating room in the surgical suite. Utilization is defined as the percentage of operating time used, divided by the OR time which is available. By analyzing each case that occurred during the normal business day, the actual time that the OR nursing staff, anesthesia personnel, and surgeons took to perform their functions for each case was determined.

The lack of room utilization primarily occurred between 0700 hours in the morning and when the first case would start, between individual cases or at the end of the normal business day. Ideally, all seven operating rooms become available at 0700 hours. Of the 1752 cases performed during the study period, 192 cases started later than 0715 hours in the morning, and 50 cases or three percent of the total cases started later than 0800 hours. The rooms for these cases were available for operating, but were not used. There were 240 cases or 14 percent of the total number of cases which ended earlier than 1515 hours during the study period. Additionally, there were

129 cases or eight percent of the total cases which ended earlier than 1430 hours and the room was not utilized for a "short case" that could have been finished prior to the 1530 scheduled close time of the surgical suite. There are many causes for late startup times and early finish times. Staffing problems and surgery cancellations are the most common reasons for this "under" utilization of available surgery time.²

The day-by-day review of utilization is shown in Appendix D. A weekly summary of this information is depicted in Table 14. Operating room utilization for individual rooms ranged from 17 percent to 100 percent on a daily basis. On a weekly basis for all rooms, utilization ranged from 74 percent to 89 percent. The institutional average utilization rate of operating rooms at MAMC during the four month study period was 83 percent. Some activity involving the patient's surgical procedure by the OR nursing staff, anesthesia personnel or surgeons was ongoing in the surgical suites 83 percent of the available time allotted to normal duty operations.

Emergency Surgeries

Emergency surgeries that disrupt an established OR schedule may occur in any hospital and are one of the primary reasons for cancellation of elective surgeries.³ Managers of the operating room must be cognizant of this fact and plan for emergencies during the operations of the surgical suite. Of the 1752 surgical cases performed in the OR at Madigan during June through September 1985, there were 133 emergency cases. The day-by-day review of emergency surgeries is shown in Appendix E. A weekly summary of this information is reflected in Table 15.

TABLE 14
UTILIZATION (%) BY WEEK AND DAY OF WEEK

<u>WEEK</u>																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
MON	87	89	87	84	81	69	81	83	H	87	76	79	81	H	90	89	85	83
TUE	82	87	82	89	76	95	96	70	78	89	84	77	79	92	88	79	88	84
WED	90	83	84	93	71	92	78	78	82	86	79	58	88	91	87	87	93	84
THU	91	85	82	94	H*	87	64	72	85	85	81	62	83	80	93	83	77	82
FRI	85	56	85	78	H*	77	71	87	65	89	78	92	94	83	88	87	93	82
TOTAL	87	80	84	88	76	84	78	78	78	87	80	74	85	87	89	85	87	83

*Holiday/closed OR

TABLE 15

EMERGENCY CASES BY WEEK AND DAY OF WEEK

	<u>WEEK</u>																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
MON	1	-	1	2	5	-	-	1	1	3	1	1	2	-	2	1	3	24
TUE	1	2	1	-	1	-	1	1	-	-	1	2	1	3	4	2	1	21
WED	3	1	3	2	4	1	3	1	2	2	1	3	2	-	2	-	5	35
THU	1	1	3	2	-	3	1	-	1	1	2	2	2	3	3	3	-	29
FRI	1	1	1	1	-	1	1	2	2	2	1	2	-	1	2	3	3	24
TOTAL	7	5	9	7	10	5	6	5	6	8	6	10	7	7	13	9	12	133

Next, an analysis of emergency cases by service was performed. Table 16 shows the percentage of emergency cases by service during the study period. This information shows that an average of 8 percent of all cases performed between 0700-1530 hours during Monday through Friday at MAMC are emergency procedures. On a daily basis, this equates to 56 percent of one operating room or 4 hours and 45 minutes of time utilized each day for emergencies.

TABLE 16
PERCENTAGE OF EMERGENCY SURGERIES BY SERVICE

SERVICE	TOTAL CASES (TC)	EMERGENCY CASES (EC)	PERCENTAGE (EC/TC x 100)
Pediatric Surgery*	17	3	18
Neurosurgery	49	8	16
Obstetrics*	29	4	14
Vascular Surgery	44	5	11
Gynecology	304	32	11
Thoracic Surgery	48	5	10
Orthopedic	353	34	9
General Surgery	410	35	8
Urology	79	3	4
Plastics	44	1	2
Otolaryngology	218	3	1
Ophthalmology	84	0	0
Oral Surgery	73	0	0
TOTAL	1752	133	

*Not separate services, but may fall into any service

When the data are analyzed from the perspective of what services are most prone to have emergency cases, three services comprise 76 percent of the cases. Table 17 shows the percentage of emergency cases by service based on the total number of emergency cases.

TABLE 17
FREQUENCY OF EMERGENCY SURGERIES BY SERVICE

SERVICE	FREQUENCY OF EMERGENCY CASES	RELATIVE FREQUENCY
General Surgery	35	26
Orthopedics	34	26
Gynecology	32	24
Neurosurgery	8	6
Thoracic Surgery	5	4
Vascular Surgery	5	4
Obstetrics*	4	3
Urology	3	2
Otolaryngology	3	2
Pediatric Surgery*	3	2
Plastic	1	1
Ophthalmology	0	0
Oral Surgery	0	1
TOTAL	133	100%

*Not separate services, but may fall into any service

Upon further analysis of the operative emergency procedures, there are 8 cases which comprise over 45 percent of the emergency as shown in Table 18.

TABLE 18
MOST COMMON EMERGENCY CASES

CASE	CODE	FREQUENCY
Treatment of Missed Abortion	59820	21
Exploratory Laparotomy	49000	10
Cholecystectomy with choangiography	47605	10
Venous Cutdown, over age 2	36491	6
Appendectomy	44950	5
I&D of Ischiorectal and/or perirectal abscess	46040	5
Bimalleolar Ankle Fracture	27814	4
D&C, nonOB	58120	4
	TOTAL	60

Cancelled Surgery

There are many causes for cancelled surgery in hospitals.⁴ When a cancellation occurs, the patient, physician(s) and OR staff are adversely affected. At Madigan, a system has been in place for over a year to determine the exact cause of each cancelled surgery.⁵ Table 19 is a list of identified reasons for cancelled surgery at MAMC. The appropriate code will be

TABLE 19
CANCELLATION CODES

1A	Surgeon Related
1	Overschedule
2	Incomplete Workup
3	Lack of Surgical Staff
4	Incomplete OP Permit
5	Intraoperative Complication
1F	Nurse Related
1	Incomplete OP Permit
2	Patient Inadequately Prepared
3	Intraoperative Complication
1G	Anesthesia Related
1	Anesthesia Complication Before Induction
2	Anesthesia Complication During Induction
3	Anesthesia Complication Post Induction
1K	Institution Related
1	Lack of OR Time
2	Lack of OR Staff
3	Lack of Anesthesia Staff
4	Lack of Equipment/Equipment Failure
5	Lack of Beds on Appropriate Wards
6	Intraoperative Complication
1L	Patient Related
1	Patient Inadequately Prepared
2	Permission Withdrawn
3	No Show
4	Medical Condition Worsened
5	Medical Condition Improved
6	Intraoperative Complication
7	Other Factor
1M	Factors Beyond Individual/Institutional Control
1	Equipment Failure
2	Institutional Disaster
3	Preempted By Emergency Case
4	Factor Beyond OR Control

entered on the operation request when the scheduled procedure is not performed. During the study period, there were 225

cancellations which equate to a 12.8 percent rate at the center (Appendix F). Table 20 shows the reasons for these cancellations, the frequency of occurrence of each reason and the relative frequency of each reason. Almost one-third of the surgeries are cancelled due to the scheduling of more cases during the day than can possibly be accomplished. If the OR and anesthesia staff knew how long each case would take, they could better plan the use of their personnel resources. If surgeons knew what the average total case duration time was for a procedure, they could be more realistic in initially establishing the planned surgery schedule.

When the data were analyzed by service, the majority of the services had cancellation rates which were greater than ten percent of their total caseload. Table 21 reflects the total cases that each service had scheduled during the study period, the number of cancellations which occurred and the resulting percentage of cancellations as compared to total cases. Some of these high cancellation rates can be attributed to the start of the academic year for Department of Surgery's new interns and residents. These percentages are extremely high according to Dr. Buck and Major Reeder.^{6,7} The data were further analyzed to determine which services had the most cancellations. Four services account for the bulk (78%) of the cancellations as shown in Table 22. A summary of the review of cancellations by week and day is shown in Table 23.

TABLE 20
REASONS FOR CANCELLATIONS

REASON	FREQUENCY	RELATIVE FREQUENCY
Surgeon Related-Overschedule	69	30.7
Patient Related-Medical Condition Worsened	42	18.7
Preempted by Emergency Case	27	12.0
Patient Related-No Show	25	11.1
Patient Related-Medical Condition Improved	12	5.3
Patient Related-Other Factor	11	4.9
Surgeon Related-Patient Inadequately Prepared	11	4.8
Patient Related-Permission Withdrawn	9	4.0
Patient Related-Patient Inadequately Prepared	8	3.7
Factor Beyond OR Control	7	3.1
Surgeon Related-Incomplete Operative Permit	2	0.9
Nurse Related-Patient Inadequately Prepared	1	0.4
Surgeon Related-Lack of Surgical Staff	<u>1</u>	<u>0.4</u>
TOTAL	225	100%

TABLE 21
PERCENTAGE OF CANCELLATIONS BY SERVICE

SERVICE	TOTAL CASES (TC)	CANCELLATIONS(C)	PERCENTAGE (TC/C X100)
Urology	79	22	28
Pediatric Surgery*	17	4	24
Neurosurgery	49	10	20
Orthopaedic Surgery	353	62	18
Thoracic Surgery	48	3	17
General Surgery	410	55	13
Gynecology	304	36	12
Plastic Surgery	44	5	11
Oral Surgery	73	7	10
Vascular Surgery	44	3	7
Otolaryngology	218	11	5
Ophthalmology	84	2	2
Obstetrics	29	0	0
TOTAL	1752	225	

*Not separate services, but may fall into any service

TABLE 22
FREQUENCY OF CANCELLATIONS BY SERVICE

SERVICE	FREQUENCY	RELATIVE FREQUENCY
Orthopaedic Surgery	62	28
General Surgery	55	24
Gynecology	36	16
Urology	22	10
Otolaryngology	11	5
Neurosurgery	10	4
Thoracic Surgery	8	4
Oral Surgery	7	3
Plastic Surgery	5	2
Pediatric Surgery*	4	2
Vascular Surgery	3	1
Ophthalmology	<u>2</u>	<u>1</u>
TOTAL	225	100%

*Not a separate service, but may fall into any service

Trend Analysis

At this point in the research, the question of whether or not any particular day of the week or week of the study period was significantly different from other time periods during the study needed to be addressed for cancellations, emergency surgeries and OR utilization. An analysis of variance (ANOVA) statistical

TABLE 23

CANCELLATIONS BY WEEK AND DAY OF WEEK

	WEEK																	TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
MON	3	-	3	6	6	5	1	2	2	2	2	4	6	-	2	2	2	48
TUE	2	3	2	2	3	2	1	-	3	6	2	5	5	4	5	3	6	54
WED	3	4	2	5	1	2	1	3	1	3	1	1	3	1	1	-	1	33
THU	4	-	-	4	-	2	3	4	2	4	4	-	3	1	4	2	3	40
FRI	-	1	4	2	-	3	4	1	5	2	3	7	3	2	4	5	4	50
TOTAL	12	8	11	19	10	14	10	10	13	17	12	17	20	9	13	12	16	225

method was used to determine if the variables differed significantly with respect to day of week during the study period. Two assumptions which were made are that (1) the populations from which the data came is normally distributed, and (2) all population variances are equal. The statistical question was set up as follows:

Null Hypothesis $H_0: \mu_1 = \mu_2 = \mu_3 \dots \mu_n$

Alternative Hypothesis H_a : Not all μ_i are equal

Level of Significance $\alpha = 0.05$

Critical Value, $F_c = F_{.05, 4, 80} = 5.67$

The data were analyzed and the results are shown in Tables 24, 25, and 26. In all three cases, there were no significant differences. These outcomes can be interpreted to mean that the specific day of the week does not, in fact, influence whether utilization, emergency surgeries or cancellations will be high or low.

TABLE 24
ANALYSIS OF VARIANCE - CANCELLATIONS

SOURCE OF VARIATION	SUM OF SQUARES	D.F.	MEAN SQUARE	F-RATIO	PROB(>F)
Total (Corr.)	265.10	84			
Days	17.81	4	4.45	1.441	.23
Error	247.29	80	3.09		

TABLE 25
ANALYSIS OF VARIANCE - EMERGENCY CASES

SOURCE OF VARIATION	SUM OF SQUARES	D.F.	MEAN SQUARE	F-RATIO	PROB(>F)
Total (Corr.)	117.11	84			
Days	6.52	4	1.63	1.179	.33
Error	110.59	80	1.38		

TABLE 26
ANALYSIS OF VARIANCE - UTILIZATION

SOURCE OF VARIATION	SUM OF SQUARES	D.F.	MEAN SQUARE	F-RATIO	PROB(>F)
Total (Corr.)	31725.81	84			
Days	1496.52	4	374.13	.990	.41786
Error	30229.29	80	377.87		

Further analysis of the data to determine if there were any correlations between utilization, cancelled surgery and emergency cases was performed. The results, shown in Table 27, indicate that the probability of any relationship existing between the three variables is extremely low. Only 17 percent of the time do emergency cases affect cancellations and 29 percent of the time emergencies affect utilization. Cancellations affect utilization 33 percent of the time and emergency cases 17 percent of the time.

TABLE 27
CORRELATION MATRIX

	CANCELLATION	EMERGENCY	UTILIZATION
Cancellations	1.00000	.16853	.33262
Emergencies	.16853	1.00000	.28906
Utilization	.33262	.28906	1.00000

Average Case Duration Times

Initially, the four month study period was to be used to isolate times required by the nursing, anesthesia and surgical staff to perform single procedure cases. Once the report formats had been written and the OR registry queried, the resulting number of cases was smaller than expected. After a discussion with the Chief of Surgery, it was decided that a review of the entire 1985 calendar year would be conducted to get sufficient numbers of cases to make the study more meaningful.⁸ It was also decided that only cases that were performed more than five times during the year would be analyzed. Table 28 reflects those single case procedures that occurred more than five times during the study period. There were 2893 cases which met these criteria. This number equates to 72 percent of the total caseload performed in the main OR at Madigan. The mathematical data collection process that was discussed earlier to determine average nursing, surgery preparation, anesthesia and

TABLE 28
SINGLE CASE PROCEDURES

SURGICAL CASE	CODE
Incision and Drainage (I&D) of Abscess	10060
I&D of Abscess Complicated	10061
I&D of Pilonidal Cyst	10080
Debridement	11044
Skin Biopsy	11100
Excision, Benign Lesion	11402
Skin Graft, Split	15100
Excision of Excessive Skin and Subcutaneous Tissue	15831
Mastotomy	19020
Breast Biopsy	19101
Breast Mastectomy, Complete	19180
Breast Mastectomy, Modified Radical	19240
Mammoplasty Reduction	19318
Mammoplasty	19324
Mammoplasty, with Prosthetic Implant	19325
Delayed Insertion of Prothesis	19342
Removal of Implant, Deep	20680
Arthrectomy, Unilateral	21051
Osteoplasty, Total	21200
Osteoplasty, Segmented	21202
Osteoplasty, Mandibular Ramus	21203
Osteoplasty, Maxilla Total	21204
Osteoplasty, Maxilla	21206
Reduction Genioplasty	21207
Mandible Graft	21215
Osteoplasty For Midface Hypoplasia or Retrusion w/o Bone Graft	21250
Osteoplasty For Midface Hypoplasia or Retrusion w/ Bone Graft	21254
Malar Fracture	21360
Excisional Biopsy	21550
Acromionectomy	23130
Capsulorrhaphy, Anterior	23450
Capsulorrhaphy, Bankhart Type	23455
Shoulder Procedure, Miscellaneous	23929
Humerus/Elbow Procedure, Miscellaneous	24999
Navicular Repair	25440
Faciectomy, Simple	26120
Arthroplasty with Prosthetic Implant, Single	26531
Hands/Fingers Procedure, Miscellaneous	26989

TABLE 28 CONTINUED

SURGICAL CASE	CODE
I&D, Pelvis	26990
Arthroplasty, Acetabular	27130
Arthroplasty, Secondary Reconstruction	27135
Open Treatment of Femoral Fracture, Proximal End	27236
Open Treatment of Intertrochanteric or Pertrochanteric Femoral Fracture	27244
I&D Femur/Knee Joint	27301
Arthroscopy, Knee Diagnostic	27373
Arthroscopy, Knee Debridement	27374
Arthroscopy w/Removal of Loose Body	27377
Arthroscopy, Knee Debridement with Meniscectomy	27378
Arthroscopy w/Plica Resection	27379
Repair Knee Ligament, Cruciate	27407
Secondary Repair Knee Ligament	27410
Secondary Repair Knee Ligament Collateral and Cruciate	27414
Total Knee Replacement	27447
Open Treatment of Femoral Shaft Fracture	27506
Open Treatment of Tibial Fracture, Proximal	27536
Amputation, Thigh	27590
I&D Leg and Ankle	27603
Repair Achilles Tendon	27650
Bimalleolar Ankle Fracture	27814
Open Treatment Tibia and Fibula Fractures	27806
Amputation, Tibula/Fibula	27880
Capsulotomy, Extensive	28262
Bunion Correction (Silver Type)	28290
Bunion Correction, (Keller/McBride/ Mayo)	28292
Phalanx Osteotomy	28298
Rhinoplasty	30400
Septoplasty	30520
Sinusotomy, Radical Unilateral with Removal Antrochonal Polyps	31032
Laryngoscopy with Biopsy	31535
Laryngoscopy w/Operating Microscope	31541
Tracheostomy	31600
Bronchoscopy, Rigid	31620
Lobectomy	32480
Wedge Resection of Lung	32500
Pacemaker Insertion Ventricular	33207
Embolectomy/Thrombectomy	34001
Repair Blood Vessel	34201

TABLE 28 CONTINUED

SURGICAL CASE	CODE
Aneurysm, Abdominal Aorta	35081
Bypass, Graft, Aortoiliac	35641
Arteriovenous Shunt	36145
Venous Cutdown, Over Age 2	36491
Ligation and Division of Long Saphenous Vein	37700
Stripping of Saphenous Veins, Unilateral	37720
Biopsy/Excision of Lymph Node	38500
Retroperitoneal Lymphadenectomy	38780
Dentoalveolar Structures	41899
Tonsillectomy/Adenoidectomy, Under 12	42820
Tonsillectomy/Adenoidectomy, 12 or over	42821
Tonsillectomy, Under 12	42825
Tonsillectomy, 12 & Over	42826
Adenoidectomy, Under 12	42830
Excision Submandibular Gland	42440
Pyloromyotomy	43520
Gastrostomy, Permanent	43832
Gastrorrhaphy	43840
Gastric Stapling	43845
Enterectomy, Resection of Small Intestine	44120
Colectomy, Partial	44140
Appendectomy	44950
I&D, Perianal Abscess	46040
Sphincterotomy	46080
Hemorrhoidectomy	46255
Cholecystectomy	47600
Cholecystectomy w/Cholangiography	47605
Cholecystectomy w/Exploration of Common Duct	47610
Exploratory Laparotomy	49000
Repair Inguinal Hernia, Under Age 5	49500
Repair Inguinal Hernia, Age 5 or Over	49505
Repair Inguinal Hernia, Recurrent	49520
Repair Ventral/Incisional Hernia	49560
Repair Umbilical Hernia, Age 5 or Over	49581
Percutaneous Nephrostolithotomy or Phelostolithotomy	50080
Nephrectomy, w/Partial Ureterectomy	50220
Nephrectomy, Radical	50230
Insertion of Penile Prosthesis	54400
Orchiopexy	54640
Excision of Hydrocele	55040
Vasovasostomy, Bilateral	55401
Excision of Varicocele	55530

TABLE 28 CONTINUED

SURGICAL CASE	CODE
Laser Destruction Vulva	56507
Anterior Colporrhaphy	57240
Cerclage of Utrine Cervix	57700
Biopsy of Cervix	57520
Dilation and Curettage, Non-OB	58120
Total Hysterectomy	58150
Total Hysterectomy, w/Colpourethro- Cystopexy	58152
Vaginal Hysterectomy	58260
Ligation/Transection of Fallopian Tubes	58600
Ligation of Fallopian Tubes	58605
Salpingo Oophorectomy	58720
Lysis of Adhesions (Salpingolysis)	58740
Tubotubal Anastomosis	58750
Salpingostomy	58770
Oophorectomy	58940
Laparscopy For Visualization of Pelvic Viscera	58980
Laparscopy with Fulguration of Oviducts	58982
Laparoscopy, w/Occlusion of Oviducts	58983
Female Genital, Non-OB, Miscellaneous	58999
Dilation and Curettage For Postpartum Hemorrhage	59160
Surgical Treatment of Ectopic Pregnancy Tubal	59120
Surgical Treatment Ectopic Pregnancy Tubal w/o Salpingectomy	59121
Treatment of Missed Abortion	59820
Total Thyroid Lobectomy, Unilateral	60220
Parathyroidectomy	60500
Craniotomy, Supratentorial	61310
Intracranial Aneurysm, Carotid Circulation	61700
Lumbar Laminectomy	62297
Laminotomy, One Interspace, Lumbar, Unilateral	63030
Transection/Avulsion of Pudendal Nerve, Unilateral	64721
Digital Nerve Repair	64831
Anastomosis, Facial Hypoglossal	64868
Excision of Pterygium	65420
Cataract Extraction w/Lens	66980
Extraction w/Lens Implantation	
Intracapsular Cataract Extraction w/Insertion of Intraocular Lens Prosthesis	66983
Extracapsular Cataract Extraction w/Insertion of Intraocular Lens Prosthesis	66984

TABLE 28 CONTINUED

SURGICAL CASE	CODE
Strabismus Surgery, One Muscle	67311
Strabismus Surgery, Two Muscles	67312
Nasolacrimal Duct Probing	68825
Tympanostomy General Anesthesia, Unilateral	69437
Tympanoplasty, w/o Mastoidectomy w/o Ossicular Chain Reconstruction	69631
Stapedectomy w/Reestablishment of Ossicular Continuity	69660
Tympanoplasty, w/o Mastoidectomy, with Ossicular Chain Reconstruction	69632
Tympanoplasty, w/Mastoidectomy, w/o Ossicular Drain Reconstruction	69635

surgery time was accomplished for the one year study period (examples shown in Appendices G through N). The resulting data are shown in Table 29. Actual sample sizes (n), mean case duration times (x), standard deviations (s), and confidence intervals for each case are shown in Table 30. A 90 percent confidence interval was used to provide a time range of values that would attempt to compensate for varying patient acuity levels and for different speeds at which surgeons operate. The confidence interval means that 90 percent of the time the case duration time will be found within the range of values identified. Again, the fact that the institution is a teaching hospital is demonstrated by the large standard deviations in some cases. The small sample sizes in many cases also affect the standard deviation values.

TABLE 29
AVERAGE CASE DURATION TIMES (MINUTES)

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Incision and Drainage (I&D) of Abscess	10060	23	13	22	33	91
I&D of Abscess Complicated	10061	22	14	35	61	132
I&D of Pilonidal Cyst	10080	24	14	25	36	99
Debridement	11044	24	10	21	32	87
Skin Biopsy	11100	23	19	40	52	134
Excision, Benign Lesion	11402	22	14	28	50	114
Skin Graft, Split	15100	21	28	37	75	161
Excision of Excessive Skin and Subcutaneous tissue	15831	25	12	32	192	261
Mastotomy	19020	25	23	27	30	105
Breast Biopsy	19101	25	20	13	40	98
Breast Mastectomy, Complete	19180	31	13	74	65	183
Breast Mastectomy, Modified Radical	19240	20	28	40	102	190
Mammaplasty Reduction	19318	11	36	30	194	271
Mammaplasty	19324	18	28	30	91	167
Mammaplasty, with Prosthetic Implant	19325	19	28	30	68	145
Delayed Insertion of Prothesis	19342	22	29	37	70	158
Removal of Implant, Deep	20680	16	25	24	51	116
Arthrectomy, Unilateral	21051	26	30	42	112	210
Osteoplasty, total	21200	25	15	50	135	225
Osteoplasty, Segmented	21202	19	13	64	109	205
Osteoplasty, Mandibular Ramus	21203	19	13	64	120	216
Osteoplasty, Maxilla total	21204	20	13	64	141	238
Osteoplasty, Maxilla	21206	20	13	58	124	215
Reduction Genioplasty	21207	23	13	48	89	173
Mandible Graft	21215	15	18	55	196	284

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Osteoplasty For Midface Hypoplasia or Retrusion w/o Bone Graft	21250	25	22	64	143	254
Osteoplasty For Midface Hypoplasia or Retrusion w/ Bone Graft	21254	25	14	70	196	305
Malar Fracture	21360	27	20	43	29	119
Excisional Biopsy	21550	23	23	49	63	158
Acromionectomy	23130	25	18	29	80	152
Capsulorrhaphy, Anterior	23450	23	19	40	101	183
Capsulorrhaphy, Bankhart type	23455	23	12	38	152	225
Shoulder Procedure, Miscellaneous	23929	23	12	42	110	187
Humerus/elbow Procedure, Misc.	24999	23	8	42	69	142
Navicular Repair	25440	25	8	25	44	102
Faciectomy, Simple	26120	23	12	38	65	138
Arthroplasty with Prosthetic Implant, Single	26531	25	8	28	94	155
Hands/fingers Procedure, Misc.	26989	20	15	35	80	150
I&D, Pelvis	26990	23	15	35	46	119
Arthroplasty, Acetabular	27130	20	32	47	136	235
Arthroplasty, Secondary Recon- struction	27135	25	46	80	286	437
Open treatment of Femoral Fracture, Proximal End	27236	42	25	42	146	255
Open treatment of Intertrochanteric or Pertrochanteric Femoral Fracture	27244	40	25	44	152	261
I&D Femur/ Knee Joint	27301	23	14	32	34	103
Arthroscopy, Knee Diagnostic	27373	23	17	34	60	134
Arthroscopy, Knee Debridement	27374	21	16	46	74	157
Arthroscopy w/ removal of Loose Body	27377	24	14	38	95	171

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Arthroscopy, Knee Debridement with Meniscectomy	27378	24	14	79	108	225
Arthroscopy w/ plica Resection	27379	24	13	35	77	149
Repair Knee Ligament, cruciate	27407	20	17	28	223	288
Secondary Repair Knee Ligament	27410	20	18	45	185	268
Secondary Repair Knee Ligament, Collateral and Cruciate	27414	23	15	40	245	323
Total Knee replacement	27447	23	22	45	199	289
Open treatment of Femoral Shaft Fracture	27506	36	15	45	165	261
Open treatment of Tibial Fracture, Proximal	27536	44	9	53	117	223
Amputation, Thigh	27590	23	14	45	85	167
I&D Leg and Ankle	27603	20	15	35	51	121
Repair Achilles tendon	27650	23	12	26	43	104
Bimalleolar Ankle Fracture	27814	33	20	15	115	183
Open treatment Tibia and Fibula Fractures	27806	31	12	27	130	200
Amputation, Tibula/ Fibula	27880	20	10	55	76	161
Capsulotomy, Extensive	28262	35	25	65	143	268
Bunion Correction (Silver type)	28290	32	11	30	82	155
Bunion Correction, (Keller/McBride/ Mayo)	28292	32	12	30	108	182
Phalanx Osteotomy	28298	23	11	34	85	153
Rhinoplasty	30400	25	20	43	80	168
Septoplasty	30520	18	19	22	62	121
Sinusotomy, Radical Unilateral with Removal Antrochonal Polyps	31032	19	12	45	57	133
Laryngoscopy with Biopsy	31535	21	10	38	21	90

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Laryngoscopy w/operating Microscope	31541	21	10	60	25	116
Tracheostomy	31600	23	13	29	40	105
Bronchoscopy, Rigid	31620	23	23	29	39	114
Lobectomy	32480	30	26	39	189	284
Wedge Resection of Lung	32500	32	26	39	154	251
Pacemaker Insertion	33207	30	23	43	103	199
Ventricular Embolectomy/ Thromectomy	34001	28	35	62	131	256
Repair Blood Vessel	34201	23	20	43	139	225
Aneurysm, Abdominal Aorta	35081	23	19	40	268	350
Bypass, Graft, Aortoiliac	35641	24	30	90	293	437
Arteriovenous Shunt	36145	23	20	43	149	235
Venous Cutdown, over Age 2	36491	50	21	31	62	164
Ligation and Division of Long Saphenous Vein	37700	23	19	40	72	154
Stripping of Saphenous Veins, Unilateral	37720	23	18	43	92	176
Biopsy/excision of Lymph Node	38500	23	30	44	42	139
Retroperitoneal Lymphadenectomy	38780	24	30	44	437	535
Dentoalveolar Structures	41899	14	0	5	111	130
Tonsillectomy/ Adenoidectomy, Under 12	42820	23	19	40	34	116
Tonsillectomy/ Adenoidectomy, 12 or over	42821	23	19	40	36	118
Tonsillectomy, Under 12	42825	18	32	65	29	144
Tonsillectomy, 12 & over	42826	22	14	37	36	109
Adenoidectomy, Under 12	42830	25	10	30	29	94

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Excision Subman Dibular Gland	42440	23	14	43	92	172
Pyloromyotomy	43520	23	13	34	39	109
Gastrostomy, Permanent	43832	30	11	43	97	181
Gastrorrhaphy	43840	28	15	40	50	133
Gastric Stapling	43845	25	21	50	135	231
Enterectomy, Resectin of Small Intestine	44120	19	18	43	138	218
Colectomy, Partial	44140	19	18	51	190	278
Appendectomy	44950	20	23	35	67	145
I&D, Perianal Abscess	46040	23	12	18	21	74
Sphincterotomy	46080	23	12	18	46	99
Hemorrhoidectomy	46255	23	20	30	43	116
Cholecystectomy	47600	37	10	39	81	167
Cholecystectomy w/cholangiography	47605	37	17	39	101	194
Cholecystectomy w/exploration of Common Duct	47610	38	10	43	183	274
Exploratory Laparotomy	49000	35	14	66	92	207
Repair Inguinal Hernia, Under Age 5	49500	26	14	44	60	144
Repair Inguinal Hernia, Age 5 or over	49505	25	13	38	75	151
Repair Inguinal Hernia, Recurrent	49520	21	10	24	72	127
Repair Ventral/ Incisional Hernia	49560	23	15	40	59	137
Repair Umbilical Hernia, Age 5 or over	49581	23	19	40	42	124
Percutaneous Nephrostolithotomy or Phelostolithotomy	50080	33	20	32	92	177
Nephrectomy, w/ Partial Ureterectomy	50220	24	33	48	151	256

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Nephrectomy, Radical	50230	24	30	62	263	379
Insertion of Penile Prosthesis	54400	28	22	60	80	190
Orchiopexy	54640	20	25	38	61	144
Excision of Hydrocele	55040	23	21	43	52	139
Vasovasostomy, Bilateral	55401	23	21	43	109	196
Excision of Varicocele	55530	30	12	39	53	134
Laser Destruction Vulva	56507	23	13	22	35	93
Anterior Colporrhaphy	57240	30	19	20	107	176
Cerclage of Utrine Cervix	57700	20	10	29	24	83
Biopsy of Cervix	57520	23	19	40	42	124
Dilation and Curettage, Non-OB	58120	15	13	20	18	66
Total Hysterectomy	58150	19	19	43	134	215
Total Hysterectomy, w/colpourethro- Cystopexy	58152	15	15	32	190	252
Vaginal Hysterec- tomy	58260	24	17	58	78	177
Ligation/ Transection of Fallopian tubes	58600	26	14	41	38	119
Ligation of Fallopian tubes	58605	28	13	27	29	97
Salpingo oophorectomy	58720	31	20	34	100	185
Lysis of Adhesions (salpingolysis)	58740	23	20	19	79	141
Tubotubal Anastomosis	58750	24	21	19	197	261
Salpingostomy	58770	23	18	20	133	194
Oophorectomy	58940	21	15	38	78	152
Laparscopy For Visualization of Pelvic Viscera	58980	19	14	38	36	107

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Laparscopy with Fulguration of oviducts	58982	21	21	49	31	122
Laparoscopy, w/ occlusion of oviducts	58983	21	21	38	38	118
Female Genital, NonOB, Misc.	58999	23	15	43	25	106
Dilation and Curettage For Postpartum Hemorrhage	59160	35	21	47	27	130
Surgical Treatment of Ectopic Pregnancy tubal	59120	30	21	47	65	163
Surgical Treatment Ectopic Pregnancy tubal w/o Salpingectomy	59121	25	21	43	69	158
Treatment of Missed Abortion	59820	35	9	33	14	91
Total Thyroid Lobectomy, Unilateral	60220	27	19	42	113	201
Parathyroidectomy	60500	23	22	43	145	233
Craniotomy, Supratentorial	61310	25	22	56	134	237
Intracranial Aneurysm, Carotid Circulation	61700	25	25	63	370	483
Lumbar Laminectomy	62297	23	19	40	145	227
Laminotomy, one Interspace, Lumbar, Unilateral	63030	20	21	25	146	212
Transection/ Avulsion of Pudanal Nerve, Unilateral	64721	23	19	40	32	124
Digital Nerve Repair	64831	20	15	50	102	187
Anastomosis, Facial Hypoglossal	64868	20	17	52	154	243
Excision of Pterygium	65420	13	10	23	14	60

TABLE 29 CONTINUED

SURGICAL CASE	CODE	PRE/POST-OP NURSING	SURGERY PREP	PRE/POST-OP ANESTHESIA	SURGERY	TOTAL TIME
Cataract Extraction w/lens Implantation	66980	26	22	4	46	98
Intracapsular Cataract Extraction w/insertion of Intraocular Lens Prosthesis	66983	19	16	8	41	84
Extracapsular Cataract Extraction w/Insertion of Intraocular Lens Prosthesis	66984	19	17	26	48	110
Strabismus Surgery, One Muscle	67311	20	16	15	51	102
Strabismus Surgery, Two Muscles	67312	25	20	17	46	108
Nasolacrimal Duct Probing	68825	23	12	30	45	110
Tympanostomy General Anesthesia, Unilateral	69437	20	19	42	16	97
Tympanoplasty, w/o Mastoidectomy, w/o Ossicular Chain Reconstruction	69631	28	29	43	116	216
Stapedectomy w/ Reestablishment of Ossicular Continuity	69660	23	19	40	123	205
Tympanoplasty, w/o Mastoidectomy, w/ Ossicular Chain Reconstruction	69632	27	23	43	106	199
Tympanoplasty, w/ Mastoidotomy, w/o Ossicular Drain Reconstruction	69635	30	20	43	243	336

TABLE 30
SAMPLING PROPERTIES

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Incision and Drainage (I&D) of Abscess	10060	11	91	25.9	43	139
I&D of Abscess Complicated	10061	8	132	38.9	70	194
I&D of Pilonidal Cyst	10080	12	99	18.2	70	128
Debridement	11044	5	87	7.0	76	98
Skin Biopsy	11100	5	134	9.0	119	148
Excision, Benign Lesion	11402	6	114	19.4	84	144
Skin Graft, Split	15100	5	161	26.1	119	203
Excision of Excessive Skin and Subcutaneous Tissue	15831	6	261	68.4	152	370
Mastectomy	19020	11	105	16.8	78	132
Breast Biopsy	19101	56	98	20.1	65	135
Breast Mastectomy, Complete	19180	7	183	25.6	141	225
Breast Mastectomy, Modified Radical	19240	13	190	13.2	168	212
Mammoplasty Reduction	19318	8	271	102.8	102	440
Mammoplasty	19324	12	167	30.9	117	217
Mammoplasty, with Prosthetic Implant	19325	7	145	38.4	84	206
Delayed Insertion of Prothesis	19342	13	158	22.0	123	193
Removal of Implant, Deep	20680	9	116	30.0	68	164
Arthrectomy, Unilateral	21051	7	210	19.7	178	242
Osteoplasty, Total	21200	5	225	52.7	140	310
Osteoplasty, Segmented	21202	9	205	64.9	101	309
Osteoplasty, Mandibular Ramus	21203	15	216	55.9	124	311
Osteoplasty, Maxilla Total	21204	6	238	45.9	164	312

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Osteoplasty, Maxilla	21206	6	215	31.1	165	265
Reduction Genioplasty	21207	6	173	64.0	71	275
Mandible Graft	21215	10	284	63.3	182	386
Osteoplasty for Midface Hypoplasia or Retrusion w/o Bone Graft	21250	6	254	53.2	169	339
Osteoplasty for Midface Hypoplasia or Retrusion w/ Bone Graft	21254	10	305	63.3	204	406
Malar Fracture	21360	8	119	13.6	97	141
Excisional Biopsy	21550	5	158	19.1	128	188
Acromionectomy	23130	6	152	23.7	114	190
Capsulorrhaphy, Anterior	23450	9	183	39.6	118	248
Capsulorrhaphy, Bankhart Type	23455	6	225	45.3	153	297
Navicular Repair	25440	6	102	19.9	69	135
Shoulder Procedure Miscellaneous	23929	5	187	33.5	133	241
Humerus/Elbow Procedure, Misc.	24999	5	142	30.9	92	192
Faciectomy, Simple	26120	14	138	24.5	98	178
Arthroplasty with Prosthetic Implant, Single	26531	9	155	28.5	110	201
Hands/Fingers Procedure, Misc.	26989	5	150	40.0	86	214
I&D, Pelvis	26990	10	119	30.0	71	167
Arthroplasty, Acetabular	27130	9	235	30.8	184	286
Arthroplasty, Secondary Recon- struction	27135	9	437	120.7	238	636
Open Treatment of Femoral Fracture, Proximal End	27236	11	255	53.2	170	340
Open Treatment of Intertrochanteric or Pertrochanteric Femoral Fracture	27244	5	261	72.4	145	376
I&D Femur/ Knee Joint	27301	6	103	14.3	81	125
Arthroscopy, Knee Diagnostic	27373	51	134	26.0	91	177

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Arthroscopy, Knee, Debridement	27374	9	157	36.6	97	217
Arthroscopy w/ Removal of Loose Body	27377	8	171	38.9	109	233
Arthroscopy, Knee, Debridement with Meniscectomy	27378	68	225	47.9	146	304
Arthroscopy w/ plica Resection	27379	9	149	45.7	75	223
Repair Knee Ligament, Cruciate	27407	7	288	57.5	195	381
Secondary Repair Knee Ligament	27410	6	268	41.6	201	335
Secondary Repair Knee Ligament, Collateral and Cruciate	27414	8	323	86.0	185	461
Total Knee Replacement	27447	7	289	54.6	201	377
Open Treatment of Femoral Shaft Fracture	27506	8	261	92.9	112	410
Open treatment of Tibial Fracture, Proximal	27536	6	223	46.6	148	298
Amputation, Thigh	27590	5	167	23.5	129	205
I&D Leg and Ankle	27603	8	121	27.5	76	169
Repair Achilles Tendon	27650	7	104	14.7	80	128
Open Treatment Tibia and Fibula Fractures	27806	5	200	62.3	101	299
Bimalleolar Ankle Fracture	27814	28	173	40.2	107	239
Amputation, Tibula/ Fibula	27880	9	161	24.0	123	199
Capsulotomy, Extensive	28262	10	268	37.5	207	329
Bunion Correction (Silver type)	28290	13	155	39.0	93	217
Bunion Correction, (Keller/McBride/ Mayo)	28292	6	182	51.1	100	264
Phalanx Osteotomy	28298	5	153	21.2	119	187
Rhinoplasty	30400	15	168	41.0	102	234
Septoplasty	30520	13	121	32.0	68	174

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Sinusotomy, Radical Unilateral with Removal Antrochonal Polyps	31032	5	133	22.3	98	168
Laryngoscopy with Biopsy	31535	12	90	12.0	71	109
Laryngoscopy w/Operating Microscope	31541	16	116	16.3	89	143
Tracheostomy	31600	12	105	32.3	54	156
Bronchoscopy, Rigid	31620	5	114	38.6	52	176
Lobectomy	32480	6	284	60.0	188	380
Wedge Resection of Lung	32500	6	251	92.2	103	398
Pacemaker Insertion Ventricular	33207	17	199	36.1	141	256
Repair Blood Vessel	34201	5	225	59.4	131	319
Embolectomy/Thromectomy	34001	55	256	37.9	194	318
Aneurysm, Abdominal Aorta	35081	12	350	48.4	270	430
Bypass, Graft, Aortoiliac	35641	5	437	73.8	319	555
Arteriovenous Shunt	36145	6	235	46.8	160	310
Venous Cutdown, Over Age 2	36491	56	164	39.9	100	228
Ligation and Division of Long Saphenous Vein	37700	19	154	26.6	110	198
Stripping of Saphenous Veins, Unilateral	37720	5	176	25.5	134	218
Biopsy/Excision of Lymph Node	38500	12	139	19.5	107	171
Retroperitoneal Lymphadenectomy	38780	7	535	202.1	212	858
Dentoalveolar Structures	41899	8	130	39.6	66	194
Excision Submandibular Gland	42440	6	172	32.7	119	225
Tonsillectomy/Adenoidectomy, Under 12	42820	19	116	16.3	90	142
Tonsillectomy/Adenoidectomy, 12 or Over	42821	14	118	16.9	91	145

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Tonsillectomy, Under 12	42825	15	144	10.1	128	160
Tonsillectomy, 12 & Over	42826	71	109	16.0	83	135
Adenoidectomy, Under 12	42830	13	94	11.8	75	113
Pyloromyotomy	43520	5	109	17.6	80	138
Gastrostomy, Permanent	43832	5	181	48.8	103	259
Gastrorrhaphy	43840	7	133	25.3	93	173
Gastric Stapling	43845	5	231	41.7	163	299
Enterectomy, Resection of Small Intestine	44120	7	218	36.5	159	277
Colectomy, Partial	44140	15	278	124	80	476
Appendectomy	44950	88	145	22.6	108	182
I&D, Perianal Abscess	46040	23	74	8.4	61	87
Sphincterotomy	46080	9	99	26.4	57	141
Hemorrhoidectomy	46255	16	116	14.6	92	140
Cholecystectomy	47600	8	167	27.6	122	212
Cholecystectomy	47605	128	194	35.2	138	250
Cholecystectomy w/Cholangiography	47610	16	274	37.0	215	333
Cholecystectomy w/Exploration of Common Duct	49000	27	207	60.3	111	303
Exploratory Laparotomy	49500	36	144	27.1	101	187
Repair Inguinal Hernia, Under Age 5	49505	188	151	28.0	106	196
Repair Inguinal Hernia, Age 5 or Over	49520	6	127	19.8	95	159
Repair Inguinal Hernia, Recurrent	49560	28	137	36.5	78	196
Repair Ventral/ Incisional Hernia	49581	17	124	22.7	87	161
Repair Umbilical Hernia, Age 5 or Over	50080	7	177	18.6	147	207
Percutaneous Nephrostolithotomy or Phelostolithotomy						

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Nephrectomy, w/ Partial Ureterectomy	50220	7	256	48.6	178	334
Nephrectomy, Radical	50230	5	379	46.1	305	453
Insertion of Penile Prosthesis	54400	19	190	22.2	155	225
Orchiopexy	54640	20	144	21.9	109	179
Excision of Hydrocele	55040	23	139	23.8	101	179
Vasovasostomy, Bilateral	55401	17	196	25.5	154	238
Excision of Varicocele	55530	15	134	17.6	105	163
Laser Destruction Vulva	56507	6	93	7.3	82	104
Anterior Colporrhaphy	57240	6	176	39.9	112	240
Biopsy of Cervix	57520	13	124	8.4	111	137
Cerclage of Utrine Cervix	57700	6	83	23.6	45	121
Dilation and Curettage, Non-OB	58120	67	66	10.0	50	82
Total Hysterectomy	58150	88	215	46.7	140	290
Total Hysterectomy, w/Colpourethro- Cystopexy	58152	18	252	59.0	158	309
Vaginal Hysterectomy	58260	66	177	36.0	119	235
Ligation/ Transection of	58600	33	119	19.8	87	151
Ligation of Fallopian Tubes	58605	7	97	11.7	78	116
Fallopian Tubes Salpingo Oophorectomy	58720	10	185	85.8	47	323
Lysis of Adhesions (Salpingolysis)	58740	7	141	18.6	110	171
Tubotubal	58750	15	261	43.7	191	331
Salpingostomy Anastomosis	58770	7	194	52.8	109	279
Oophorectomy	58940	13	152	35.5	94	210
Laparscopy for Visualization of Pelvic Viscera	58980	99	107	11.7	88	126

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Laparscopy with Fulguration of Oviducts	58982	16	122	11.6	103	141
Laparoscopy, w/ Occlusion of Oviducts	58983	13	118	11.3	100	136
Female Genital, NonOB, Misc.	58999	5	106	18.9	76	136
Surgical Treatment of Ectopic Pregnancy Tubal	59120	6	163	25.4	123	203
Surgical Treatment Ectopic Pregnancy Tubal w/o Salpingectomy	59121	10	158	30.9	108	208
Dilation and Curettage for Postpartum Hemorrhage	59160	28	130	14.3	108	152
Treatment of Missed Abortion	59820	86	91	8.2	78	104
Total Thyroid Lobectomy, Unilateral	60220	16	201	24.0	163	239
Parathyroidectomy	60500	6	233	44.3	163	303
Craniotomy, Supratentorial	61310	6	237	55.7	147	327
Intracranial Aneurysm, Carotid Circulation	61700	6	483	96.9	328	638
Lumbar Laminectomy	62297	26	227	43.7	157	297
Laminotomy, One Interspace, Lumbar, Unilateral	63030	11	212	43.5	142	282
Transection/ Avulsion of Pudanal Nerve, Unilateral	64721	13	114	16.1	88	140
Digital Nerve Repair	64831	5	187	55.5	97	277
Anastomosis, Facial Hypoglossal	64868	5	243	43.5	173	313
Excision of Pterygium	65420	5	70	3.9	64	76

TABLE 30 CONTINUED

CASE	CODE	n	x	s	90% CONFIDENCE INTERVALS	
					LOW	HIGH
Cataract Extraction w/Lens Implantation	66980	155	98	13.9	76	120
Intracapsular Cataract Extraction w/Insertion of Intraocular Lens Prosthesis	66983	19	84	11.4	66	102
Extracapsular Cataract Extraction w/Insertion of Intraocular Lens Prosthesis	66984	13	110	14.4	88	132
Strabismus Surgery, One Muscle	67311	9	102	17.4	75	129
Strabismus Surgery, Two Muscles	67312	13	108	5.1	100	116
Nasolacrimal Duct Probing	68825	6	110	47.0	35	185
Tympanostomy, General Anesthesia, Unilateral	69437	15	97	9.7	81	113
Tympanoplasty, w/o Mastoidectomy, w/o Ossicular Chain Reconstruction	69631	35	216	55.6	126	306
Stapedectomy w/ Reestablishment of Ossicular Continuity	69660	16	205	36.7	146	264
Tympanoplasty, w/o Mastoidectomy, w/ ossicular Chain Reconstruction	69632	5	199	27.6	154	244
Tympanoplasty, w/ Mastoidectomy, w/o ossicular Drain Reconstruction	69635	16	336	83.3	198	469

Surgeon's Activity Profile

There are 39 medical staff surgeons, 40 surgery residents, and 21 surgery interns at Madigan. The population of residents and interns changes each year which causes the duration time of each surgery case to vary more than if a stable medical staff existed. Because of the "teaching" mission at MAMC, the residents and interns attempt to operate on as many different types of cases as possible. This factor causes the repetition of the same type procedure to be less likely to occur. An analysis to determine the average time to perform each case by surgeon at Madigan was not performed because of these reasons.

Pilot Study

After having gathered all of the predictive information described above, the pilot study was ready to be conducted. The information was shared with the service chiefs and the primary physician(s) who were responsible for scheduling patients for surgery. Most surgeons viewed the data as being relatively accurate in most cases. However, they continually stressed the fact that when dealing with residents and interns in the teaching environment and dealing with patients who have varying degrees of surgical needs, there will be large variations in time needed for the operations.

Also, the retrospective study information was provided to the OR nursing staff and the anesthesia staff. This segment of the staff looked forward to using the predictive data to accurately forecast a realistic surgery schedule. During the

four month retrospective study, it was found that there were 244 cases (15% of the total number of cases) which went past the 1530 hour closing time for elective surgeries. This factor alone causes the OR nursing and anesthesia staff to be dissatisfied with the predictability of the surgery schedule.

The study was conducted as projected in the research methodology. There were 357 cases which were performed during normal operating hours from 5 May through 30 May 1986. During the four week test, utilization averaged 79 percent (Table 31). There were 38 emergency surgeries which affected the established schedule (Table 32). Cancellations during the month averaged 8.5 percent of the total number of cases scheduled (Table 33). The highest frequency of cancellations by service was Orthopaedic Surgery which is to be expected because of the volume of surgeries that the service handles and because of the acuity of the patients seen by the surgeons of this service. Table 34 shows the actual cancellations by service, Table 35 reflects the percentage of cancellations by service and Table 36 provides the reasons for the case cancellations.

TABLE 31
OR UTILIZATION (%)
5-30 May 1986

	WEEK			
	1	2	3	4
Monday	82	63	81	Holiday
Tuesday	75	77	84	72
Wednesday	73	75	88	60
Thursday	76	84	92	82
Friday	81	83	85	85

TABLE 32
EMERGENCY SURGERIES
5-30 May 1986

	WEEK			
	1	2	3	4
Monday	3	2	1	-
Tuesday	2	2	2	2
Wednesday	3	2	3	-
Thursday	1	-	1	3
Friday	2	2	4	3

TABLE 33
CASE CANCELLATIONS
5-30 May 1986

	WEEK			
	1	2	3	4
Monday	6	-	-	Holiday
Tuesday	5	-	4	-
Wednesday	6	4	1	-
Thursday	-	-	1	1
Friday	-	-	4	2

TABLE 34
FREQUENCY OF CANCELLATIONS BY SERVICE
5-30 May 1986

SERVICE	FREQUENCY	RELATIVE FREQUENCY
Orthopaedic Surgery	8	23.5
General Surgery	5	14.7
Gynecology	4	11.8
Vascular Surgery	4	11.8
Otolaryngology	3	8.8
Thoracic Surgery	3	8.8
Plastic Surgery	3	8.8
Urology	1	2.9
Neurosurgery	1	2.9
Oral Surgery	1	2.9
Ophthalmology	1	2.9
TOTAL	34	99.8%

TABLE 35
 PERCENTAGE OF CANCELLATIONS BY SERVICE
 5-30 May 1986

SERVICE	TOTAL CASES (TC)	CANCELLATIONS(C)	PERCENTAGE TC/C X 100
Vascular Surgery	7	4	57
Thoracic Surgery	8	3	38
Plastic Surgery	21	3	14
Orthopaedic Surgery	87	8	9
Neurosurgery	11	1	9
Oral Surgery	13	1	8
Otolaryngology	42	3	7
Urology	16	1	6
General Surgery	88	5	6
Gynecology	66	4	6
Ophthalmology	28	1	4
Pediatric Surgery*	4	-	-
TOTALS	399	34	

*Not a separate service, but may fall into any service

TABLE 36
 REASONS FOR CANCELLATIONS
 5-30 May 1986

REASON	FREQUENCY	RELATIVE FREQUENCY
Patient Related - Medical Condition Worsened	10	29.4
Preempted By Emergency Case	4	11.8
Surgeon Related - Overscheduled	4	11.8
Patient Related - Medical Improved	3	8.8
Surgeon Related - Incomplete Workup	3	8.8
Beyond OR Control	3	8.8
Procedure Moved to Same Day Surgery/Clinic	2	5.9
Lack of Surgical Staff	1	2.9
Failure of Equipment	1	2.9
Lack of Bed Space	1	2.9
Patient No Show	1	2.9
Patient Withdrew Permission	1	2.9
TOTALS	34	99.8%

FOOTNOTES

¹Interview with Alfred S. Buck, Chief, Department of Surgery, Madigan Army Medical Center, Tacoma, Washington, 28 August 1985.

²Interview with Leanna M. Clutter, Chief, Operating Room Nursing Section, Madigan Army Medical Center, Tacoma, Washington, 20 August 1985.

³Kanella T. Phillips, "Operating Room Utilization," Hospital Topics (March/April 1975): 44.

⁴Michael Nathanson, "Computer-aided scheduling can put scalpel to costs of operating room," Modern Healthcare (May 1, 1984): 44.

⁵Interview with Jean M. Reeder, Operating Room Coordinator, Department of Nursing, Madigan Army Medical Center, Tacoma, Washington, 20 August 1985.

⁶Ibid., Buck, 23 October 1985.

⁷Ibid., Reeder, 4 March 1986.

⁸Ibid., Buck, 3 March 1986.

III. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There are many factors which affect the efficient utilization of Madigan's operating rooms. The pace of the surgical staff during the procedure, whether or not the patient is brought down from the nursing ward on time, whether or not this is a "routine" or "difficult" procedure, a delay in the previous case's completion time and whether or not the anesthetic or preparation procedure consumes more time than expected are some of the causes for less than optimal OR management. Many of these factors are controllable, but the real key to establishing an efficient, realistic operating room schedule is knowing how much time must be reserved for a given procedure.¹ Studies in the civilian sector of our nation's health care system have shown a positive effect of scheduling the use of the operating rooms based upon using average case duration times.^{2,3} This method of OR scheduling reduces the variation in length of operating sessions and ensures the best use of available operating time.

The most fundamental principle of efficient management of the surgical procedures performed within the Operating Room is the proper scheduling of time in the OR suites.⁴ At Madigan the cases are sequentially scheduled based upon the operating room suite availability. This sequencing is an "educated guess" by the primary operating surgeon and the Chief

of Anesthesiology and Operative Service or his representative, of how long each case will take. As a result, patients and their families are not apprised of when their case will start other than "probably morning" or "probably afternoon." The accuracy and timeliness of information about the patients' treatment is very important to satisfaction levels. Most patients define these dimensions as more important than getting well.⁵

The ideal way to get more surgeries performed and have fewer patient surgeries cancelled is to add more staff and create more operating rooms. However, because of personnel, financial and facility constraints, this is not a viable option for Madigan Army Medical Center. A systematic approach to efficient management and utilization of the current surgical suites must be established to optimize surgery scheduling at MAMC.

By using predictive information of average case duration times, the surgery scheduling process at Madigan Army Medical Center was improved. Utilization and the emergency caseload of the Madigan surgical suites remained relatively constant, but most importantly, the cancellation rate of surgical cases dropped from 12.8 percent to 8.5 percent.

Some of the research project's established criteria were not achieved, however. OR utilization, at 79 percent, did not quite meet the 80 percent goal, but according to previously referenced literature, this range is quite acceptable. Only three services (Vascular, Thoracic, and Plastic Surgery) did not achieve a cancellation rate of 10 percent or less. Although these services performed only 9 percent of the total cases during the test period, they had 29 percent of the total case cancellations.

The remaining criteria were fully met. Madigan's institutional case cancellation rate was less than the stated 10 percent objective and all services used the predictive average case duration times to match available time with the patient workload requirements in establishing their elective surgery schedule.

A critical element in the success of this approach was the acceptance of the concept by the surgical staff. In many instances, surgeons were surprised that the average surgery time corresponded closely to the time that they expected a specific case to take. They were surprised by the nursing and anesthesia times for some cases. It was noted by several members of the surgical staff that the specific surgical, nursing, and anesthesia team performing the case influenced the time required to perform each element of the procedure. However, by using the information shown in Table 29, the scheduling of elective cases was accomplished more analytically and less subjectively which proved to be a more prudent approach to surgery scheduling.

Emergency cases which affect the schedule were similar during the retrospective study and the test period. This factor, being so predictable, should be addressed by the Department of Surgery Staff and the Madigan command element as a problem which adversely affects surgery scheduling.

Recommendations

This analysis was supported by all elements involved in the surgery scheduling process. The outcomes were well received and felt to be useful information. Based on the study, numerous recommendations are made.

Initially, a functional operating room committee should be created to establish firm operating room policies and provide continuous guidance to institutional users of the OR. The committee should recommend to the MAMC Commanding General a clearer line of authority for daily OR operations than currently exists in the institution. OR utilization and productivity goals should be established by this committee and routinely monitored via the automated registry.

It is recommended that the proposed predictive data be routinely used to prepare the surgical services operating schedule. This predictive data must be updated periodically as the input of operative cases continues over time and statistical averages can be derived from larger sample sizes.

Next, the report formats which were used to obtain the statistical and descriptive information shown in this graduate research project should be automated into a program which will allow the NCR central processing unit to perform the required sorts, data manipulations and mathematical computations to obtain the necessary outputs or reports. The program should be flexible enough to allow service/section chiefs to get information concerning only their clinicians or service/sections and to obtain information for specific time periods during the year. Also the program should allow for combinations of cases which the clinician knows from experience will normally occur together.

The OR time which is routinely used for emergency cases must be programmed. Based on this study, there is an average of four to five hours a day that one operating room is required to be

utilized for emergency cases. Unless the patient population supported by the tertiary health care institution of Madigan changes, the number of daily emergency cases will be relatively constant during the coming years. The eighth operating room at Madigan is currently being used part-time by the Same Day Surgery Service to perform minor surgeries on patients who receive only local anesthesia. In lieu of cancelling elective cases because an emergency patient needed an operation, the eighth operating room should be fully staffed with anesthesia and OR nursing personnel to meet the surgical demand of emergency cases for the average stated time period. This approach of managing emergency cases would effectively reduce the total amount of cancelled surgery by 13 percent on a daily basis.

Finally, the concept of a surgery scheduling process using predictive data should be disseminated throughout the military health care system. This systematic approach to OR scheduling management has a demonstrated potential to increase utilization, decrease cancellations, improve staff efficiency and increase patient satisfaction.

Pressures throughout the federal government to increase productivity and reduce inefficiencies in military hospitals will continue to heighten in the years to come. A laissez faire approach to the economic consequences of management of the operating room could prove disastrous to the military health care institutions which have not taken a proactive approach to OR management.

FOOTNOTES

¹K. H. Hanson, "Computer-Assisted Operating Room Scheduling," Journal of Medical Systems 6 (June 1982): 311.

²Michael Nathanson, "Computer-aided scheduling can put scalpel to costs of operating room," Modern Healthcare (May 1, 1984): 46.

³Donald F. McQuarrie, "Limits to Efficient Operating Room Scheduling," Archives of Surgery 116 (August 1981): 1070-1071.

⁴Diana C. Wilson, "Efficient OR Management," Nursing Management 15 (May 1984): 38D.

⁵Grant S. Dobson and others, "High Tech, High Touch," Hospitals and Health Services Administration (March/April 1986): 84.

APPENDIX A
DEFINITIONS

APPENDIX A

DEFINITIONS

AVERAGE CASE DURATION TIME - The statistical mean time required to perform a particular surgical case. This time includes a summation of the average nursing, anesthesia, surgery preparation and surgeon time required for the case.

CASE - A case is a patient who requires one or more surgical interventions (procedures or episodes) during his/her OR encounter.

OR REGISTRY - A NCR Computer System which is comprised of a central processing unit and multiple use software package designed to store data pertaining to surgical cases performed in the operating room.

PROCEDURE - A procedure is a single surgical intervention or episode which is performed for a specific service on a patient.

SHORT CASE - A surgical case which could be performed in 120 minutes or less.

SURGICAL TEAM - The surgical team is comprised of three operational elements of the hospital staff. These elements are the nursing staff, anesthesia staff and surgeons.

APPENDIX A CONTINUED

UTILIZATION - Utilization equals the total OR time in minutes available, divided by the actual OR time in minutes taken for a case. It is often expressed as a percentage, which means the fraction obtained is multiplied by 100 to obtain the utilization percentage.

APPENDIX B
OPERATION REQUEST AND WORKSHEET

OPERATION REQUEST AND WORKSHEET For use of this form, see AR 40-407; the proponent agency is the Office of The Surgeon General									
SECTION A - REQUEST FOR SURGERY									
1. PATIENT'S NAME (Last, First, MI) (Print)			2. STATUS	3. AGE	4. RELIGION	5. REGISTER NO		6. SSN (with Family Member Prefix)	
7. PREOPERATIVE DIAGNOSIS							8. NURSING UNIT (from - to)		
9. OPERATION PROPOSED							10. REQUESTING SERVICE		
11. DATE OF SURGERY		12. TIME OR CASE NO		13. SCHEDULE PRIORITY (check one) <input type="checkbox"/> EMERGENCY <input type="checkbox"/> SEMI-EMERGENCY <input type="checkbox"/> ROUTINE			14. BLOOD REQUIRED (Unit) cc		15. SEPTIC
16. SURGEON			17. ASSISTANT(S)			18. POSITION OF PNT		19. PREP REQUIRED	
20. NURSING STAFF				21. ANESTHETIST(S)				22. ANESTHESIA	
23. SPECIAL INSTRUCTIONS AND REMARKS									
24. REQUESTING OFFICER (Printed Name and Signature)									
SECTION B - OPERATION WORKSHEET									
25. OPERATING ROOM NO		26. TIME OR CASE NO		27. SEPTIC		28. FLUIDS (other than blood)		29. BLOOD ADMINISTERED	
30. SURGEON			31. ASSISTANT(S)			32. ANESTHETIST(S)		33. ANESTHESIA TIME (Began and Ended)	
34. INDUCTION ANESTHETIC	AGENT		TECHNIQUE		37. AIRWAY		39. SPECIAL PROCEDURES (Anesthesia)		
35. PRIMARY ANESTHETIC	AGENT		TECHNIQUE		38. RELAXANTS INTUBATION OTHER				
36. SECONDARY ANESTHETIC	AGENT		TECHNIQUE						
40. NURSING TIME (Began and Ended)		41. SCRUBBED PERSON(S)				42. CIRCULATING PERSON(S)			
43. OPERATION DATE		44. OPERATION TIME (Began and Ended)		45. DRAINS		46. SPONGE COUNT		47. LABORATORY SPECIMEN	
48. OPERATIVE DIAGNOSIS									
49. OPERATION(S) PERFORMED								<input type="checkbox"/> EPISODES OF SURGERY	
50. COMPLICATIONS (Continue on reverse, if more space is required)									
51. DICTATOR'S NAME, SERVICE & PHONE EXT								RECORDED IN REGISTER (Initials)	

APPENDIX C
EXAMPLE OF SURGICAL PROCEDURES

APPENDIX C
EXAMPLE OF SURGICAL PROCEDURES

CASE	PERFORMED OPERATION	SURGERY DATE
Skin Graft	15100	85/08/28
	15100	85/09/21
	15100	85/08/28
Breast Biopsy, needle	19100	85/06/07
Breast Biopsy, Incisional	19101	85/06/18
	19101	95/06/04
	19101	85/06/07
	19101	85/06/21
	19101	85/06/24
Mastectomy, lymph	19162	85/09/05
Mastectomy, complete	19180	85/07/25
	19180	85/06/27
Mastectomy, radical	19240	85/07/19
Mastopexy	19316	85/07/16
Implant Removal	20680	85/07/30
Coronoidectomy	21070	85/07/09
Osteoplasty	21200	85/07/02
Osteotomy	21203	85/07/05
	21203	85/08/09
	21203	85/08/09
	21203	85/08/13
Mandible Graft	21215	85/07/26
Osteoplasty of maxilla	21250	85/08/07
Osteoplasty w/bone graft	21254	85/08/30
Malar fracture	21360	85/08/15
	21360	85/09/27
	21360	85/07/24
Arthrodesis	22561	85/08/21
Lumbar Spine Fusion	22720	85/08/28
Clavicle Excision	23180	85/06/05
Humerus Excision	24110	85/08/07
Tendon Repair	24305	85/07/31
Elbow Fracture	24825	85/06/21
Muscle Repairs	25260	85/08/21
Scaphoid Repair	25440	85/07/31

APPENDIX D
OPERATING ROOM UTILIZATION

APPENDIX D

OR UTILIZATION (%)

3-7 June 1985

OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	99	90	94	86	97	93
2	38	94	91	100	94	83
3	99	99	76	67	74	83
4	99	35	83	99	100	83
5	96	74	94	97	55	83
6	99	86	94	91	83	91
7	81	93	96	96	95	92
Avg Daily Util	87	82	90	91	85	87

10-14 June 1985

OR #	Mon	Tue	Wed	Thu	Fri	Average OR Utilization
1	76	100	59	99	36	74
2	94	99	97	99	25	83
3	81	100	67	40	42	66
4	96	67	91	95	86	87
5	88	50	99	80	72	78
6	89	98	75	99	82	89
7	98	93	94	83	49	83
Avg Daily Util	89	87	83	85	56	80

APPENDIX D CONTINUED

OR UTILIZATION (%)

17-21 June 1985

OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	79	98	92	88	85	74
2	100	95	75	50	77	79
3	98	81	86	95	82	88
4	99	67	94	88	89	87
5	80	69	70	99	86	81
6	70	100	92	93	98	91
7	85	67	77	64	78	74
Avg Daily Util	87	82	84	82	85	84

24-28 June 1985

OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	58	86	94	95	91	85
2	99	98	99	99	92	97
3	89	100	92	79	98	92
4	96	100	92	99	80	93
5	99	60	88	100	100	89
6	81	82	92	97	25	75
7	67	99	96	86	61	82
Avg Daily Util	84	89	93	94	78	88

APPENDIX D CONTINUED

OR UTILIZATION (%)

1-5 July 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	82	21	78	H	H	60
2	99	84	96	O	O	93
3	98	73	84	L	L	85
4	96	98	90	I	I	95
5	84	97	64	D	D	82
6	85	72	68	A	A	75
7	20	88	18	Y	Y	42
Avg Daily Util	81	76	71			76

8-12 July 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	17	98	94	94	99	80
2	20	100	96	95	100	82
3	90	100	83	68	70	82
4	91	87	94	96	41	82
5	90	100	92	66	90	88
6	80	99	94	99	98	94
7	97	83	89	94	38	80
Avg Daily Util	69	95	92	87	77	84

APPENDIX D CONTINUED

OR UTILIZATION (%)

15-19 July 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	38	99	80	54	94	73
2	99	97	94	88	50	86
3	83	95	38	98	92	81
4	52	99	94	66	98	82
5	97	96	76	83	76	86
6	97	98	75	58	87	83
7	98	85	91			55
Avg Daily Util	81	96	78	64	71	78

22-26 July 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	91	34	99	47	98	74
2	96	94	94	92	45	84
3	98	75	64	39	84	72
4	35	72	96	100	95	80
5	99	35	72	47	100	71
6	76	85	77	80	88	81
7	84	93	43	99	99	84
AVG Daily Util	83	70	78	72	87	78

APPENDIX D CONTINUED

OR UTILIZATION (%)

29 July - 1 August 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	C	47	55	75	23	50
2	L	98	91	83	0	68
3	O	55	64	72	65	64
4	S	89	95	91	73	87
5	E	96	93	87	99	94
6	D	95	97	96	95	96
7		68	81	90	99	85
AVG Daily Util		78	82	85	65	78

5-9 August 1986						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	86	80	76	98	89	86
2	94	99	96	97	95	96
3	88	98	82	82	69	84
4	92	99	73	98	98	92
5	93	69	94	83	92	86
6	80	87	94	94	99	91
7	77	90	90	41	78	75
Avg Daily Util	87	89	86	85	89	87

APPENDIX D CONTINUED

OR UTILIZATION (%)

12-16 August 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	98	73	85	99	34	78
2	89	74	94	97	85	88
3	77	81	65	48	79	70
4	90	92	58	92	100	86
5	97	83	94	59	76	82
6	80	92	74	85	91	84
7	0	96	84	86	79	69
Avg Daily Util	76	84	79	81	78	80

19-23 August 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	98	83	88	0	100	74
2	84	95	0	93	96	74
3	99	81	49	93	85	81
4	89	85	65	99	83	84
5	85	97	63	76	92	83
6	99	0	85	71	92	69
7	0	97	55	0	97	50
Avg Daily Util	79	77	58	62	92	74

APPENDIX D CONTINUED

OR UTILIZATION (%)

26-30 August 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	100	91	88	67	98	89
2	90	0	96	98	99	77
3	83	84	72	47	92	76
4	77	93	83	99	97	89
5	89	94	84	99	73	88
6	55	98	94	76	99	84
7	75	96	97	97	99	93
Avg Daily Util	81	79	88	83	94	85

2-6 September 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	H	94	94	79	82	87
2	O	98	99	87	82	92
3	L	87	88	96	53	81
4	I	97	93	99	98	97
5	D	75	76	98	83	83
6	A	97	93	99	85	94
7	Y	99	92	0	96	72
Avg Daily Util		92	91	80	83	87

APPENDIX D CONTINUED

OR UTILIZATION (%)

9-13 September 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	77	95	94	93	93	90
2	80	78	93	100	81	86
3	96	82	55	85	60	76
4	95	100	94	90	91	94
5	88	78	93	96	97	90
6	99	87	84	99	91	92
7	94	97	97	88	100	95
Avg Daily Util	90	88	87	93	88	89

16-20 September 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	99	93	94	88	88	92
2	97	99	99	76	95	93
3	77	86	57	68	72	72
4	89	86	80	99	82	87
5	85	94	91	78	90	88
6	98	94	94	70	93	90
7	75	0	96	99	86	71
Avg Daily Util	89	79	87	83	87	85

APPENDIX D CONTINUED

OR UTILIZATION (%)

23-27 September 1985						
OR #	Mon	Tue	Wed	Thur	Fri	Average OR Utilization
1	76	97	93	96	96	92
2	98	98	94	84	79	91
3	73	84	91	68	98	83
4	66	99	87	70	95	83
5	99	47	96	86	94	84
6	85	95	96	43	99	84
7	99	99	94	91	93	95
Avg Daily Util	85	88	93	77	93	87

APPENDIX E
EMERGENCY CASES BY SURGICAL DATE

APPENDIX E

EMERGENCY CASES BY SURGICAL DATE

REQUESTING SERVICE	SURGICAL DATE	OPERATIONS PERFORMED	PRIMARY SURGEON	ER
GenSurg	85/06/03	36491	Dr. Hall	1
OB	85/06/04	57700	Dr. Brumfiel	1
GenSurg	85/06/05	47605	Dr. Hall	1
GenSurg	85/06/05	49000 48120 44300 43830	Dr. Sinclair	1
GYN	85/06/05	58120	Dr. Magelssen	1
GenSurg	85/06/06	47605	Dr. Smith	1
GenSurg	85/06/07	44950	Dr. Nyreen	1
VasSurg	85/06/11	34101	Dr. O'Reilly	1
GYN	85/06/11	58940 49000	Dr. Stone	1
GenSurg	85/06/12	44000 09952	Dr. Hall	1
GYN	85/06/13	58980	Dr. Rawlins	1
GYN	85/06/14	59820	Dr. Williams	1
Neurosurgery	85/06/17	61155	Dr. Rozanski	1
GenSurg	85/06/18	47605	Dr. Ortenzo	1
Ortho	85/06/19	27814	Dr. Erpelding	1
GYN	85/06/19	59820	Dr. Parks	1
GenSurg	85/06/19	44950	Dr. Smith	1
GenSurg	85/06/20	49505	Dr. O'Reilly	1
Ortho	85/06/20	27536	Dr. Peterson	1
GYN	85/06/20	59820	Dr. Rawlins	1
Ortho	85/06/21	27125	Dr. Johnstone	1
Ortho	85/06/23	11044	Dr. Johnstone	1
Ortho	85/06/24	25620	Dr. Wilson	1
GYN	85/06/24	59820	Dr. Stewart	1
OB	85/06/24	59500	Dr. Polzin	1
Plastic	85/06/26	12011 12018	Dr. Clift	1
Neurosurgery	85/06/26	61310	Dr. LeBlanc	1
GenSurg	85/06/27	49020	Dr. O'Reilly	1
PedSurg	85/06/27	33820	Dr. Fiore	1
GYN	85/06/28	57135	Dr. Johansen	1
GenSurg	85/07/01	36491	Dr. Ludvigson	1
GenSurg	85/07/01	49000	Dr. Sinclair	1
GYN	85/07/01	59121 58700	Dr. Polzin	1
Neurosurgery	85/07/01	62297	Dr. LeBlanc	1
GenSurg	85/07/01	44799 50205	Dr. Sinclair	1
GYN	85/07/02	59820	Dr. Elg	1
GYN	85/07/03	59300	Dr. Mukai	1
OB	85/07/03	59820	Dr. Southmayd	1
Ortho	85/07/03	27537	Dr. Peterson	1
Ortho	85/07/03	27841	Dr. Johnstone	1
GenSurg	85/07/07	49000	Dr. Ludvigson	1

APPENDIX E CONTINUED

REQUESTING SERVICE	SURGICAL DATE	OPERATIONS PERFORMED	PRIMARY SURGEON	ER
GenSurg	85/07/10	49000 44141 44143	Dr. Ludvigson	1
OB	85/07/11	59160	Dr. Ilika	1
PedSurg	85/07/11	49000 44950	Dr. Ludvigson	1
GenSurg	85/07/11	36491	Dr. Ludvigson	1
GU	85/07/12	52601	Dr. Davis	1
GU	85/07/16	54520	Dr. Rozanski	1
ThoracicSurg	85/07/17	33010	Dr. O'Reilly	1
Ortho	85/07/17	25250 64831	Dr. Peterson	1
Ortho	85/07/17	27814	Dr. Arciero	1
Ortho	85/07/18	27880	Dr. Wiegman	1
GYN	85/07/19	58150 09952	Dr. Eldridge	1
GYN	85/07/22	59820	Dr. Nace	1
OB	85/07/23	59820	Dr. Ilika	1
Neurosurgery	85/07/25	61703	Dr. Roberts	1
GYN	85/07/26	59820	Dr. Eldridge	1
ENT	85/07/26	42962	Dr. Morris	1
OB	85/07/29	59500	Dr. Boley	1
GenSurg	85/07/29	36491	Dr. Hart	1
GenSurg	85/07/31	49000 44120 49255	Dr. Sinclair	1
Ortho	85/07/31	25628	Dr. Arciero	1
GenSurg	85/08/01	38100	Dr. O'Reilly	1
GenSurg	85/08/02	45300 44144	Dr. O'Reilly	1
GYN	85/08/02	57410 58980 44950 49000	Dr. Williams	1
GU	85/08/05	54700	Dr. R. Davis	1
GenSurg	85/08/05	44950	Dr. Fox	1
Ortho	85/08/05	28899	Dr. Wiegman	1
ENT	85/08/07	31511	Dr. Arnold	1
GYN	85/08/07	59820	Dr. Polzin	1
Ortho	85/08/08	26370 64830	Dr. Johnstone	1
Ortho	85/08/09	25611	Dr. Parr	1
VasSurg	85/08/09	34001	Dr. O'Reilly	1
ThoracicSurg	85/08/12	31621 39400 32100	Dr. Sinclair	1
Ortho	85/08/13	26670	Dr. Peterson	1
ThoracicSurg	85/08/14	32100 32210	Dr. Sinclair	1
Ortho	85/08/15	25575	Dr. Parr	1
GYN	85/08/15	59820	Dr. Southmayd	1
GenSurg	85/08/16	38500	Dr. Jaendl	1
GYN	85/08/19	58980	Dr. Nace	1
GYN	85/08/20	59820	Dr. Elg	1
GenSurg	85/08/20	44950	Dr. Jaendl	1
Ortho	85/08/21	27506 27196 27758	Dr. Buck	1
GYN	85/08/21	59820	Dr. Elg	1
PedSurg	85/08/21	49000 38500 09952	Dr. Ludvigson	1
GYN	85/08/22	59820	Dr. Eldridge	1
Neurosurgery	85/08/22	61156	Dr. Roberts	1
Ortho	85/08/23	27792	Dr. Johnson	1
GYN	85/08/23	59820	Dr. Williams	1

APPENDIX E CONTINUED

REQUESTING SERVICE	SURGICAL DATE	OPERATIONS PERFORMED	PRIMARY SURGEON	ER
GYN	85/08/26	59121	Dr. Rawlins	1
GenSurg	85/08/26	44950	Dr. Jaindl	1
GYN	85/08/27	58700 49000	Dr. Nace	1
GYN	85/08/28	58120	Dr. Spain	1
GYN	85/08/28	59820	Dr. Spain	1
GenSurg	85/08/29	49000	Dr. O'Reilly	1
ENT	85/08/29	31535	Dr. Arnold	1
GenSurg	85/09/03	36491	Dr. Fox	1
Ortho	85/09/03	12004	Dr. Wiegman	1
Ortho	85/09/03	27436	Dr. Wiegman	1
GenSurg	85/09/05	47605	Dr. Brattlof	1
Ortho	85/09/05	27502	Dr. Erpelding	1
Ortho	85/09/05	28003	Dr. Ludvigson	1
OB	85/09/06	59520	Dr. R-Davis	1
Neurosurgery	85/09/09	61310	Dr. Roberts	1
GYN	85/09/09	58150	Dr. Williams	1
VasSurg	85/09/10	36491	Dr. Brattlof	1
GenSurg	85/09/10	47605	Dr. O'Reilly	1
Ortho	85/09/10	27792	Dr. Johnson	1
GYN	85/09/10	58140 09952	Dr. R-Davis	1
GYN	85/09/11	59820	Dr. Grover	1
VasSurg	85/09/11	34201	Dr. O'Reilly	1
GenSurg	85/09/12	27603 27600	Dr. Fox	1
GenSurg	85/09/12	46040	Dr. Remar	1
Ortho	85/09/12	27414	Dr. Gordon	1
Ortho	85/09/13	27806	Dr. Johnstone	1
GenSurg	85/09/13	10080	Dr. W. Smith	1
Ortho	85/09/16	27766	Dr. Crollard	1
Ortho	85/09/17	24160	Dr. Peterson	1
Ortho	85/09/17	26032	Dr. Gordon	1
ThoracicSurg	85/09/19	33010	Dr. Fiore	1
VasSurg	85/09/19	35301	Dr. Sinclair	1
ThoracicSurg	85/09/19	33207	Dr. Fiore	1
GenSurg	85/09/20	43520	Dr. O'Reilly	1
GenSurg	85/09/20	49425	Dr. Deyo	1
Neurosurgery	85/09/20	61700	Dr. Roberts	1
Ortho	85/09/23	25260 64856	Dr. Camp	1
GYN	85/09/23	58900 58770	Dr. Rawlins	1
GYN	85/09/23	58120	Dr. Williams	1
Ortho	85/09/24	27244	Dr. Wiegman	1
Ortho	85/09/25	10061	Dr. Johnson	1
GenSurg	85/09/25	10140	Dr. Brattlof	1
GenSurg	85/09/25	46000 46040	Dr. W. Smith	1
GYN	85/09/25	57020 58980 44950	Dr. Boley	1
Ortho	85/09/25	24685	Dr. Borgatti	1
Neurosurgery	85/09/27	62192	Dr. LeBlanc	1
Ortho	85/09/27	25545	Dr. Wiegman	1
Ortho	85/09/27	27301	Dr. B. Johnson	1

APPENDIX F
SURGERY CANCELLATIONS
JUNE-SEPTEMBER 1985

APPENDIX F

SURGERY CANCELLATIONS
JUNE-SEPTEMBER 1985

DATE	SSAN	SERVICE	CANCELLATION CODE
85-06-03	20-356-70-7629-01	GENERAL SURGERY	1 A 1
85-06-03	20-303-54-8902-01	GENERAL SURGERY	1 A 1
85-06-03	30-536-66-7970-01	GYNECOLOGY	1 A 1
85-06-04	20-144-14-0054-01	GENERAL SURGERY	1 L 5
85-06-04	30-385-09-4148-01	ORTHOPAEDIC SURGERY	1 A 1
85-06-05	30-398-01-9828-01	GENERAL SURGERY	1 A 1
85-06-05	30-293-64-3219-01	GENERAL SURGERY	1 A 1
85-06-05	20-256-88-9150-01	GENERAL SURGERY	1 A 1
85-06-06	20-385-01-6417-01	OTOLARYNGOLOGY	1 A 1
85-06-06	20-446-66-8641-01	ORTHOPAEDIC SURGERY	1 A 1
85-06-06	20-558-48-3595-01	GENERAL SURGERY	1 A 1
85-06-06	30-559-25-6238-01	GYNECOLOGY	1 L 4
85-06-11	20-535-16-6894-02	ORTHOPAEDIC SURGERY	1 L 4
85-06-11	20-201-03-1792-01	GENERAL SURGERY	1 F 2
85-06-11	20-484-58-7856-01	ORTHOPAEDIC SURGERY	1 W 3
85-06-12	30-197-16-3870-01	THORACIC SURGERY	1 M 4
85-06-12	20-337-64-4371-01	ORAL SURGERY	1 L 2
85-06-12	20-399-03-1403-01	OPHTHALMOLOGY	1 L 4
85-06-12	30-197-16-3870-01	THORACIC SURGERY	1 M 4
85-06-14	30-269-68-0452-01	GYNECOLOGY	1 L 3
85-06-17	30-345-18-5951-01	GYNECOLOGY	1 L 3
85-06-17	20-542-34-4974-01	THORACIC SURGERY	1 L 4
85-06-17	20-586-60-0414-01	GENERAL SURGERY	1 L 3
85-06-18	30-534-54-5922-01	ORTHOPAEDIC SURGERY	1 L 3
85-06-18	30-419-12-8147-01	GENERAL SURGERY	1 L 4
85-06-19	30-535-18-6678-01	GENERAL SURGERY	1 L 7
85-06-19	30-521-58-0969-01	GENERAL SURGERY	1 M 3
85-06-21	30-285-32-8432-01	GENERAL SURGERY	1 A 2
85-06-21	20-304-68-1731-01	ORTHOPAEDIC SURGERY	1 M 3
85-06-21	20-307-80-9796-01	ORTHOPAEDIC SURGERY	1 M 3
85-06-21	30-563-13-0114-01	GYNECOLOGY	1 L 4
85-06-24	30-540-48-3796-01	THORACIC SURGERY	1 L 4
85-06-24	20-107-44-8221-01	ORTHOPAEDIC SURGERY	1 M 3
85-06-24	20-247-42-1032-01	GENERAL SURGERY	1 L 1
85-06-24	30-336-52-2177-01	GYNECOLOGY	1 A 1
85-06-24	30-333-32-3958-01	GYNECOLOGY	1 M 3
85-06-24	50-235-90-2937-01	GYNECOLOGY	1 A 1
85-06-25	30-519-44-3604-01	GENERAL SURGERY	1 M 4
85-06-25	20-548-27-7126-01	ORTHOPAEDIC SURGERY	1 A 1
85-06-26	30-249-15-5729-01	GENERAL SURGERY	1 M 3

APPENDIX F CONTINUED

DATE	SSAN	SERVICE	CANCELLATION CODE
85-06-26	20-247-54-0503-01	GENERAL SURGERY	1 A 1
85-06-26	30-243-46-1874-01	ORTHOPAEDIC SURGERY	1 L 3
85-06-26	20-240-94-7622-01	GENERAL SURGERY	1 M 7
85-06-26	20-585-25-8042-02	PLASTIC SURGERY	1 M 3
85-06-27	30-551-01-5204-01	ORTHOPAEDIC SURGERY	1 L 4
85-06-27	20-533-86-1249-03	ORTHOPAEDIC SURGERY	1 M 4
85-06-27	30-503-24-0350-01	ORTHOPAEDIC SURGERY	1 A 1
85-06-27	20-425-32-1217-01	UROLOGY	1 L 7
85-06-28	20-534-64-1695-01	ORTHOPAEDIC SURGERY	1 L 4
85-06-28	01-357-40-3745-01	OTOLARYNGOLOGY	1 L 5
85-07-01	30-574-08-1335-01	GENERAL SURGERY	1 L 4
85-07-01	20-570-72-5958-01	ORTHOPAEDIC SURGERY	1 M 3
85-07-01	20-547-38-0786-01	UROLOGY	1 A 1
85-07-01	30-485-09-1204-01	GYNECOLOGY	1 L 4
85-07-01	30-480-38-9879-02	GENERAL SURGERY	1 M 3
85-07-01	30-042-05-4845-01	GYNECOLOGY	1 L 7
85-07-02	30-380-26-0488-01	GENERAL SURGERY	1 L 1
85-07-02	03-536-50-1022-01	UROLOGY	1 L 3
85-07-02	20-550-14-4360-01	NEUROSURGERY	1 L 2
85-07-03	02-200-54-7215-01	PEDIATRIC SURGERY	1 M 3
85-07-08	30-562-54-2658-02	GENERAL SURGERY	1 A 2
85-07-08	30-331-26-1298-01	GYNECOLOGY	1 L 4
85-07-08	20-543-07-1970-01	GENERAL SURGERY	1 M 4
85-07-08	20-542-32-4974-01	GENERAL SURGERY	1 L 5
85-07-08	20-535-14-7130-01	OTOLARYNGOLOGY	1 L 4
85-07-09	20-575-26-7237-01	UROLOGY	1 A 1
85-07-09	20-307-80-9796-02	ORTHOPAEDIC SURGERY	1 A 4
85-07-10	30-532-32-6566-01	GENERAL SURGERY	1 L 4
85-07-10	30-277-24-0249-01	GENERAL SURGERY	1 A 1
85-07-11	20-461-25-4265-01	UROLOGY	1 L 2
85-07-11	20-539-48-2628-01	NEUROSURGERY	1 L 1
85-07-12	20-520-72-7383-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-12	20-496-30-9215-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-12	02-262-59-7029-01	PEDIATRIC SURGERY	1 L 4
85-07-15	30-430-39-7811-01	GYNECOLOGY	1 L 4
85-07-16	30-937-34-8027-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-17	20-562-50-9689-03	UROLOGY	1 A 1
85-07-18	20-535-14-7130-03	OTOLARYNGOLOGY	1 L 2
85-07-18	20-416-58-4415-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-18	20-257-47-0815-01	UROLOGY	1 L 3
85-07-19	20-237-02-5543-01	ORTHOPAEDIC SURGERY	1 L 5
85-07-19	02-521-88-0090-01	PEDIATRIC SURGERY	1 M 4
85-07-19	20-526-54-4929-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-19	20-535-38-3687-01	UROLOGY	1 L 7

APPENDIX F CONTINUED

DATE	SSAN	SERVICE	CANCELLATION CODE
85-07-22	30-410-78-4684-01	GYNECOLOGY	1 A 2
85-07-22	30-229-26-0229-01	THORACIC SURGERY	1 L 4
85-07-24	30-570-22-8476-02	PLASTIC SURGERY	1 L 3
85-07-24	20-544-16-5067-01	GENERAL SURGERY	1 L 4
85-07-24	20-106-44-2360-01	THORACIC SURGERY	1 A 1
85-07-25	20-108-24-1976-01	UROLOGY	1 A 1
85-07-25	20-106-44-2360-02	THORACIC SURGERY	1 A 1
85-07-25	20-263-29-3643-02	GYNECOLOGY	1 A 6
85-07-25	20-269-12-5733-03	ORTHOPAEDIC SURGERY	1 A 2
85-07-26	20-337-72-1708-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-29	30-345-18-5951-01	GYNECOLOGY	1 L 4
85-07-29	30-527-50-9864-01	GYNECOLOGY	1 L 3
85-07-30	30-537-26-2806-01	GENERAL SURGERY	1 A 1
85-07-30	01-387-32-7174-01	ORTHOPAEDIC SURGERY	1 A 1
85-07-30	30-262-35-6022-01	GYNECOLOGY	1 A 1
85-07-31	30-495-30-8453-01	GENERAL SURGERY	1 A 2
85-08-01	20-238-62-4950-01	NEUROSURGERY	1 A 2
85-08-01	20-556-25-7873-01	ORAL SURGERY	1 L 3
85-08-02	20-582-56-6621-01	UROLOGY	1 A 1
85-08-02	01-579-80-4603-01	PEDIATRIC SURGERY	1 L 4
85-08-02	20-540-64-3056-01	GYNECOLOGY	1 M 3
85-08-02	20-517-38-0386-01	GENERAL SURGERY	1 M 3
85-08-02	20-342-07-3731-02	GENERAL SURGERY	1 L 2
85-08-05	20-149-24-6677-01	GENERAL SURGERY	1 M 3
85-08-05	20-544-03-2963-01	UROLOGY	1 L 4
85-08-06	20-509-26-1669-01	UROLOGY	1 L 4
85-08-06	20-508-38-4078-01	NEUROSURGERY	1 L 4
85-08-06	20-485-46-8662-01	ORTHOPAEDIC SURGERY	1 L 3
85-08-06	20-423-64-6852-01	ORTHOPAEDIC SURGERY	1 A 1
85-08-06	30-573-60-1214-01	GENERAL SURGERY	1 A 1
85-08-06	20-285-78-4557-02	ORAL SURGERY	1 A 4
85-08-07	20-048-07-0114-02	GENERAL SURGERY	1 L 7
85-08-07	30-443-18-3522-01	PLASTIC SURGERY	1 A 2
85-08-07	02-447-12-4087-02	GENERAL SURGERY	1 A 1
85-08-08	30-542-32-8379-01	GYNECOLOGY	1 A 1
85-08-08	02-536-36-3344-01	ORAL SURGERY	1 L 4
85-08-08	30-535-14-2831-01	ORTHOPAEDIC SURGERY	1 L 4
85-08-08	20-164-34-9523-01	NEUROSURGERY	1 A 1
85-08-09	20-046-34-5225-01	GENERAL SURGERY	1 A 1
85-08-09	30-141-03-6059-01	GYNECOLOGY	1 L 3
85-08-12	30-331-26-1298-02	GYNECOLOGY	1 L 4
85-08-12	02-443-43-4087-01	VASCULAR SURGERY	1 L 4
85-08-13	30-586-22-5160-01	UROLOGY	1 L 4
85-08-13	20-455-01-2739-01	VASCULAR SURGERY	1 L 7
85-08-14	30-538-07-2216-01	GENERAL SURGERY	1 L 4

APPENDIX F CONTINUED

DATE	SSAN	SERVICE	CANCELLATION CODE
85-08-15	20-063-50-5859-01	ORTHOPAEDIC SURGERY	1 M 3
85-08-15	20-218-90-7305-01	ORAL SURGERY	1 L 3
85-08-15	20-382-82-3323-02	ORTHOPAEDIC SURGERY	1 M 3
85-08-15	30-575-84-2461-01	GYNECOLOGY	1 A 1
85-08-16	01-551-56-4643-01	ORTHOPAEDIC SURGERY	1 M 3
85-08-16	20-536-78-7626-01	ORTHOPAEDIC SURGERY	1 M 3
85-08-16	30-236-14-1094-01	GYNECOLOGY	1 A 1
85-08-19	20-227-18-4335-01	GENERAL SURGERY	1 A 1
85-08-19	20-382-82-3323-03	ORTHOPAEDIC SURGERY	1 M 3
85-08-19	30-422-62-7311-01	ORTHOPAEDIC SURGERY	1 M 3
85-08-19	20-448-14-3161-01	OTOLARYNGOLOGY	1 L 7
85-08-20	20-543-30-4931-01	UROLOGY	1 A 1
85-08-20	20-538-64-9790-01	GENERAL SURGERY	1 L 3
85-08-20	30-538-28-8148-01	GYNECOLOGY	1 L 1
85-08-20	20-522-25-6100-01	ORTHOPAEDIC SURGERY	1 L 4
85-08-20	20-077-60-5547-01	ORTHOPAEDIC SURGERY	1 M 3
85-08-21	20-264-32-6524-01	GENERAL SURGERY	1 L 1
85-08-23	30-543-86-7556-01	GYNECOLOGY	1 A 1
85-08-23	30-540-24-5447-01	ORTHOPAEDIC SURGERY	1 L 4
85-08-23	02-485-36-4578-01	ORTHOPAEDIC SURGERY	1 A 1
85-08-23	30-422-62-7311-02	ORTHOPAEDIC SURGERY	1 M 3
85-08-23	30-378-68-4922-01	ORTHOPAEDIC SURGERY	1 A 1
85-08-23	30-241-83-3778-01	GENERAL SURGERY	1 A 1
85-08-23	30-230-86-0364-01	GYNECOLOGY	1 P 1
85-08-26	30-543-54-1478-01	GENERAL SURGERY	1 A 1
85-08-26	20-514-07-9731-01	ORTHOPAEDIC SURGERY	1 A 1
85-08-26	30-436-52-5575-01	OTOLARYNGOLOGY	1 L 4
85-08-26	30-345-18-5951-02	GYNECOLOGY	1 L 4
85-08-26	20-312-66-5638-01	GYNECOLOGY	1 L 4
85-08-26	30-304-36-9337-01	GENERAL SURGERY	1 M 3
85-08-27	20-518-66-9687-01	NEURCSURGERY	1 A 1
85-08-27	20-458-02-8459-01	ORTHOPAEDIC SURGERY	1 L 3
85-08-27	20-306-14-6016-01	UROLOGY	1 A 1
85-08-27	30-562-54-2237-01	GENERAL SURGERY	1 L 7
85-08-27	20-162-62-8294-01	UROLOGY	1 A 1
85-08-28	20-565-46-3527-01	GENERAL SURGERY	1 A 1
85-08-28	20-535-14-2952-01	THORACIC SURGERY	1 L 2
85-08-28	20-540-20-5281-02	OPHTHALMOLOGY	1 L 7
85-08-29	20-398-70-7919-01	ORTHOPAEDIC SURGERY	1 A 2

APPENDIX F CONTINUED

DATE	SSAN	SERVICE	CANCELLATION CODE
85-08-29	03-310-34-5585-01	ORTHOPAEDIC SURGERY	1 L 3
85-08-29	20-251-17-1700-01	ORTHOPAEDIC SURGERY	1 L 3
85-08-30	20-113-10-9328-01	GENERAL SURGERY	1 L 4
85-08-30	30-419-20-9816-01	ORTHOPAEDIC SURGERY	1 L 3
85-08-30	20-536-26-7669	PLASTIC SURGERY	1 A 1
85-09-03	30-567-05-0372-01	GYNECOLOGY	1 A 1
85-09-03	20-533-88-3471-01	NEUROSURGERY	1 L 4
85-09-03	20-398-70-7919-02	ORTHOPAEDIC SURGERY	1 L 5
85-09-03	30-306-24-9277-01	GENERAL SURGERY	1 L 5
85-09-04	20-486-22-4656	UROLOGY	1 A 2
85-09-05	30-576-14-4404	ORTHOPAEDIC SURGERY	1 L 4
85-09-06	20-452-36-3881-01	UROLOGY	1 L 4
85-09-06	01-259-02-6017-01	UROLOGY	1 L 7
85-09-09	02-226-54-6170-01	ORTHOPAEDIC SURGERY	1 L 1
85-09-09	20-157-48-6206-01	GYNECOLOGY	1 L 1
85-09-10	20-514-60-9355-01	GENERAL SURGERY	1 A 2
85-09-10	20-537-20-3612-01	GENERAL SURGERY	1 A 1
85-09-10	20-557-80-7492-01	VASCULAR SURGERY	1 M 3
85-09-10	20-539-64-8628-01	UROLOGY	1 L 3
85-09-10	20-526-21-9413-01	NEUROSURGERY	1 A 2
85-09-11	01-548-43-1043-01	UROLOGY	1 L 3
85-09-12	20-535-03-6467-01	OTOLARYNGOLOGY	1 A 1
85-09-12	30-534-34-7139-01	ORTHOPAEDIC SURGERY	1 M 3
85-09-12	30-473-05-3783-01	ORTHOPAEDIC SURGERY	1 L 4
85-09-12	30-342-42-6916-03	GYNECOLOGY	1 L 3
85-09-13	30-444-60-7502-01	GYNECOLOGY	1 L 3
85-09-13	30-451-32-7816-01	GENERAL SURGERY	1 A 6
85-09-13	20-570-46-4681-01	ORTHOPAEDIC SURGERY	1 L 3
85-09-13	30-534-34-7139-01	ORTHOPAEDIC SURGERY	1 L 2
85-09-16	20-538-36-0618-03	OTOLARYNGOLOGY	1 A 1
85-09-16	30-456-38-6992-01	GYNECOLOGY	1 L 4
85-09-17	20-431-72-0128-01	ORTHOPAEDIC SURGERY	1 A 1
85-09-17	20-386-88-7106-01	ORTHOPAEDIC SURGERY	1 A 1
85-09-17	30-526-58-8033-01	GENERAL SURGERY	1 A 6
85-09-19	20-432-17-2177-01	ORAL SURGERY	1 L 7
85-09-19	01-320-66-1299-03	ORTHOPAEDIC SURGERY	1 L 4
85-09-20	20-544-68-7652-01	OTOLARYNGOLOGY	1 A 6
85-09-20	20-492-20-1183-01	UROLOGY	1 A 1
85-09-20	20-471-92-0311-01	GENERAL SURGERY	1 A 1
85-09-20	01-263-03-3537-01	ORTHOPAEDIC SURGERY	1 L 5
85-09-20	20-136-14-1057-03	GENERAL SURGERY	1 L 5

APPENDIX F CONTINUED

DATE	SSAN	SERVICE	CANCELLATION CODE
85-09-23	30-329-40-8124-01	GYNECOLOGY	1 L 2
85-09-23	30-257-38-4051-01	GYNECOLOGY	1 L 5
85-09-24	20-543-76-0907-01	ORTHOPAEDIC SURGERY	1 A 1
85-09-24	20-533-88-3421-01	NEUROSURGERY	1 L 4
85-09-24	20-526-25-0709-01	ORTHOPAEDIC SURGERY	1 L 2
85-09-24	30-521-10-8134-01	GENERAL SURGERY	1 L 5
85-09-24	20-409-37-4320-02	ORAL SURGERY	1 L 4
85-09-24	04-405-44-0059-01	ORTHOPAEDIC SURGERY	1 L 3
85-09-25	01-536-72-5862-01	PLASTIC SURGERY	. L 1
85-09-26	30-540-86-6183-01	GYNECOLOGY	1 L 3
85-09-26	20-183-44-3486-01	OTOLARYNGOLOGY	1 L 5
85-09-26	20-102-18-6636-02	NEUROSURGERY	1 A 3
85-09-27	20-552-04-8150-01	OTOLARYNGOLOGY	1 L 5
85-09-27	20-418-80-5305-01	ORTHOPAEDIC SURGERY	1 M 3
85-09-27	30-260-56-4427-02	GENERAL SURGERY	1 A 1
85-09-27	20-260-27-3240-01	ORTHOPAEDIC SURGERY	1 M 3

APPENDIX G
PREOPERATIVE NURSING TIME

APPENDIX G
PREOPERATIVE NURSING TIME

CASE	OPERATION PERFORMED	BEGIN NURSING TIME	BEGIN ANESTHESIA TIME	TOTAL MINUTES
Skin Graft	15100	07 10	07 20	10
	15100	07 30	07 50	20
	15100	13 20	13 30	10
Breast Biopsy, needle	19100	11 05	11 20	15
Breast Biopsy, incisional	19101	12 50	13 00	10
	19101	14 35	14 45	10
	19101	11 45	12 00	15
	19101	09 30	09 50	20
	19101	10 10	11 15	65
Mastectomy, lymph	19162	10 50	10 55	5
Mastectomy, complete	19180	14 01	14 10	9
	19180	12 40	13 15	35
Mastectomy, radical	19240	07 05	07 15	10
Mastopexy	19316	10 59	11 05	6
Implant removal	20680	11 59	12 05	6
Coronoidectomy	21070	06 45	07 01	16
Osteoplasty	21200	06 50	07 05	15
Osteotomy	21203	07 05	07 15	10
	21203	10 05	10 15	10
	21203	07 05	07 10	5
	21203	10 35	10 40	5
Mandible Graft	21215	12 25	12 30	5
Osteoplasty of maxilla	21250	07 30	07 45	15
Osteoplasty w/bone graft	21254	09 45	09 55	10
Malar fracture	21360	10 15	10 40	25
	21360	11 50	12 01	11
	21360	09 30	09 50	20
Arthrodesis	22561	07 01	07 15	14
Lumbar Spine Fusion	22720	07 10	07 15	5
Clavicle Excision	23180	12 01	12 15	14
Humerus Excision	24110	12 50	13 01	11
Tendon repair	24305	07 05	07 14	9
Elbow Fracture	24825	07 05	07 30	25
Muscle repairs	25260	12 10	12 20	10
Scaphoid Repair	25440	12 50	13 00	10

APPENDIX H
POSTOPERATIVE NURSING TIME

APPENDIX H
POSTOPERATIVE NURSING TIME

CASE	OPERATION PERFORMED	END ANESTHESIA TIME	END NURSING TIME	TOTAL MINUTES
Skin Graft	15100	09 30	09 40	10
	15100	10 50	10 59	9
	15100	15 27	15 30	3
Breast Biopsy, needle	19100	12 45	12 55	10
Breast Biopsy, incisional	19101	14 15	14 25	10
	19101	16 15	16 25	10
	19101	12 59	13 10	11
	19101	10 55	11 10	15
	19101	13 45	13 55	10
Mastectomy, lymph	19162	14 35	14 40	5
Mastectomy, complete	19180	16 10	16 20	10
	19180	15 50	15 59	9
Mastectomy, radical	19240	10 45	10 55	10
Mastopexy	19316	15 30	15 35	5
Implant removal	20680	12 55	13 05	10
Coronoidectomy	21070	10 10	10 20	10
Osteoplasty	21200	09 35	09 45	10
Osteotomy	21203	09 40	09 50	10
	21203	12 50	13 05	15
	21203	10 35	10 45	10
	21203	12 45	12 55	10
Mandible Graft	21215	15 35	15 45	10
Osteoplasty of maxilla	21250	12 15	12 25	10
Osteoplasty w/bone graft	21254	15 15	15 25	10
Malar Fracture	21360	11 59	12 10	11
	21360	16 15	16 25	10
	21360	11 45	11 50	5
Arthrodesis	22561	15 12	15 20	8
Lumbar Spine Fusion	22720	14 15	14 30	15
Clavicle Excision	23180	13 59	14 10	11
Humerus Excision	24110	13 55	14 05	10
Tendon repair	24305	09 55	10 05	10
Elbow Fracture	24825	08 50	08 55	5
Muscle repairs	25260	13 30	13 40	10
Scaphoid repair	25440	14 25	14 40	15

APPENDIX I
TOTAL AND AVERAGE NURSING TIME

APPENDIX I
TOTAL AND AVERAGE NURSING TIME
(MINUTES)

CASE	OPERATION PERFORMED	PREOP TIME	POSTOP TIME	TOTAL TIME	AVG TIME
Skin Graft	15100	10	10	20	21
	15100	20	9	29	
	15100	10	3	13	
Breast Biopsy, needle	19100	15	10	25	25
Breast Biopsy, incisional	19101	10	10	20	25
	19101	10	10	20	
	19101	15	11	26	
	19101	20	15	35	
	19101	65	10	75	75
Mastectomy, lymph	19162	5	5	10	10
Mastectomy, complete	19180	9	10	19	31
	19180	35	9	44	35
Mastectomy, radical	19240	10	10	20	20
Mastopexy	19316	6	5	11	11
Implant removal	20680	6	10	16	16
Coronoidectomy	21070	16	10	26	26
Osteoplasty	21200	15	10	25	25
Osteotomy	21203	10	10	20	19
	21203	10	15	25	
	21203	5	10	15	
	21203	5	10	15	
Mandible Graft	21215	5	10	15	15
Osteoplasty of maxilla	21250	15	10	25	25
Osteoplasty w/bone graft	21254	10	10	20	20
Malar fracture	21360	25	11	36	27
	21360	11	10	21	
	21360	20	5	25	
Arthrodesis	22561	14	8	22	22
Lumbar Spine Fusion	22720	5	15	20	20
Clavicle Excision	23180	14	11	25	25
Humerus Excision	24110	11	10	21	21
Tendon repair	24305	9	10	19	19
Elbow Fracture	24825	25	5	30	30
Muscle repairs	25260	10	10	30	30
Scaphoid repair	25440	10	15	25	25

APPENDIX J
TOTAL AND AVERAGE SURGERY PREPARATION TIME

APPENDIX J

TOTAL AND AVERAGE SURGERY PREPARATION TIME

CASE	OPERATION PERFORMED	BEGIN PREP TIME	BEGIN SURGERY TIME	TOTAL TIME (MIN)	AVG TIME (MIN)
Skin Graft	15100	07 50	08 10	20	29
	15100	08 15	08 51	36	
	15100	13 45	14 16	31	
Breast Biopsy, needle	19100	11 30	11 53	23	23
Breast Biopsy, incisional	19101	13 05	13 30	25	20
	19101	14 55	15 21	26	
	19101	12 10	12 28	18	
	19101	10 01	10 13	12	
	19101	11 22	11 40	18	
Mastectomy, lymph	19162	11 25	11 36	11	11
Mastectomy, complete	19180	14 32	14 47	15	13
	19180	14 40	14 51	11	
Mastectomy, radical	19240	07 40	08 08	28	28
Mastopexy	19316	11 30	12 06	36	36
Implant removal	20680	12 14	12 24	10	10
Coronoidectomy	21070	07 35	08 05	30	30
Osteoplasty	21200	08 05	08 20	15	15
Osteotomy	21203	07 58	08 07	9	13
	21203	10 45	11 05	20	
	21203	07 47	07 57	10	
	21203	11 13	11 19	13	
Mandible Graft	21215	13 10	13 28	18	18
Osteoplasty of maxilla	21250	08 14	08 36	22	22
Osteoplasty w/bone graft	21254	11 01	11 15	14	14
Malar fracture	21360	10 46	10 55	11	20
	21360	12 30	12 59	29	
	21360	10 10	10 30	20	
Arthrodesis	22561	08 01	08 30	29	29
Lumbar Spine Fusion	22720	07 45	08 46	61	61
Clavicle Excision	23180	12 40	13 06	26	26
Humerus Excision	24110	13 10	13 22	12	12
Tendon repair	24305	07 45	07 57	12	12
Elbow Fracture	24825	07 50	07 58	8	8
Muscle Repairs	25260	12 42	12 50	8	8
Scaphoid Repair	25440	13 20	13 28	8	8

APPENDIX K
PREOPERATIVE ANESTHESIA TIME

APPENDIX K
PREOPERATIVE ANESTHESIA TIME

CASE	OPERATION PERFORMED	BEGIN ANESTHESIA TIME	BEGIN PREP TIME	TOTAL MINUTES
Skin Graft	15100	07 20	07 50	30
	15100	07 50	08 15	25
	15100	13 30	13 45	15
Breast Biopsy, needle	19100	11 20	11 30	10
Breast Biopsy, incisional	19101	13 00	13 05	5
	19101	14 45	14 55	10
	19101	12 00	12 10	10
	19101	09 50	10 01	11
	19101	11 15	11 22	7
Mastectomy, lymph	19162	10 55	11 25	30
Mastectomy, complete	19180	14 10	14 32	22
	19180	13 15	14 40	80
Mastectomy, radical	19240	07 15	07 40	25
Mastopexy	19316	11 05	11 30	25
Implant removal	20680	12 05	12 14	9
Coronoidectomy	21070	07 01	07 35	34
Osteoplasty	21200	07 05	08 05	60
Osteotomy	21203	07 15	07 58	43
	21203	10 15	10 45	30
	21203	07 10	07 47	37
	21203	10 40	11 13	33
	21215	12 30	13 10	40
Mandible Graft	21250	07 45	08 14	29
Osteoplasty of maxilla	21254	09 55	11 01	66
Osteoplasty w/bone graft	21360	10 40	10 46	6
Malar fracture	21360	12 01	12 30	29
	21360	09 50	10 10	20
	22561	07 15	08 01	46
Arthrodesis	22720	07 15	07 45	30
Lumbar Spine Fusion	23180	12 15	12 40	25
Clavicle Excision	24110	13 01	13 10	9
Humerus Excision	24305	07 14	07 45	31
Tendon repair	24825	07 30	07 50	20
Elbow Fracture	25260	12 20	12 42	22
Muscle Repairs	25440	13 00	13 20	20
Scaphoid Repair				

APPENDIX L
POSTOPERATIVE ANESTHESIA TIME

APPENDIX L
POSTOPERATIVE ANESTHESIA TIME

CASE	OPERATION PERFORMED	END SURGERY TIME	END ANESTHESIA TIME	TOTAL TIME MINUTES
Skin Graft	15100	09 20	09 30	10
	15100	10 30	10 50	20
	15100	15 15	15 27	12
Breast Biopsy needle	19100	12 28	12 45	17
Breast Biopsy incisional	19101	14 15	14 15	0
	19101	16 15	16 15	0
	19101	12 55	12 59	4
	19101	10 45	10 55	10
	19101	13 35	13 45	10
Mastectomy, lymph	19162	13 59	14 35	36
Mastectomy, complete	19180	15 50	16 10	20
	19180	15 25	15 50	25
Mastectomy, radical	19240	10 40	10 45	5
Mastopexy	19316	15 25	15 30	5
Implant removal	20680	12 40	12 55	15
Coronoidectomy	21070	09 45	10 10	25
Osteoplasty	21200	09 22	09 35	13
Osteotomy	21203	09 14	09 40	26
	21203	12 10	12 50	40
	21203	10 01	10 35	34
	21203	12 34	12 45	11
Mandible Graft	21215	15 20	15 35	15
Osteoplasty of maxilla	21250	11 40	12 15	35
Osteoplasty w/bone graft	21254	14 45	15 15	30
Malar fracture	21360	11 39	11 59	20
	21360	15 50	16 15	25
	21360	11 15	11 45	30
Arthrodesis	22561	15 09	15 12	3
Lumbar Spine Fusion	22720	14 01	14 15	14
Clavicle Excision	23180	13 55	13 59	4
Humerus Excision	24110	13 45	13 55	10
Tendon repair	24305	09 40	09 55	15
Elbow Fracture	24825	08 35	08 50	15
Muscle Repairs	25260	13 25	13 30	5
Scaphoid Repair	25440	14 20	14 25	5

APPENDIX M
TOTAL AND AVERAGE ANESTHESIA TIME (MINUTES)

APPENDIX M

TOTAL AND AVERAGE ANESTHESIA TIME (MINUTES)

CASE	OPERATION PERFORMED	PREOP TIME	POSTOP TIME	TOTAL TIME	AVG TIME
Skin Graft	15100	30	10	40	37
	15100	25	20	45	
	15100	15	12	27	
Breast Biopsy, needle	19100	10	17	27	27
Breast Biopsy, incisional	19101	5	0	5	13
	19101	10	0	10	
	19101	10	4	14	
	19101	11	10	21	
	19101	7	10	17	
Mastectomy, lymph	19162	30	36	66	66
Mastectomy, complete	19180	22	20	42	74
	19180	80	25	105	74
Mastectomy, radical	19240	25	5	30	30
Mastopexy	19316	25	5	30	30
Implant removal	20680	9	15	24	24
Coronoidectomy	21070	34	25	59	59
Osteoplasty	21200	60	13	73	73
Osteotomy	21203	43	26	69	64
	21203	30	40	70	
	21203	37	34	71	
	21203	33	11	44	
	21203	33	11	44	
Mandible Graft	21215	40	15	55	55
Osteoplasty of maxilla	21250	29	35	64	64
Osteoplasty w/bone graft	21254	66	30	96	96
Malar fracture	21360	6	20	26	43
	21360	29	25	54	
	21360	20	30	50	
Arthrodesis	22561	46	3	49	49
Lumbar Spine Fusion	22720	30	14	44	44
	22720	30	14	44	
Clavicle Excision	23180	25	4	29	29
Humerus Excision	24110	9	10	19	19
Tendon repair	24305	31	15	46	46
Elbow Fracture	24825	20	15	35	35
Muscle repairs	25260	22	5	27	27
Scaphoid repair	25440	20	5	25	25

APPENDIX N
TOTAL AND AVERAGE SURGERY TIME

APPENDIX N
TOTAL AND AVERAGE SURGERY TIME

CASE	OPERATION PERFORMED	SURGEON	BEGIN SURGERY TIME	END SURGERY TIME	TOT TIME (MIN)	AVG TIME (MIN)
Skin Graft	15100	Scheidmann	8 10	9 20	70	76
	15100	Clift	8 51	10 30	99	
	15100	Deyo	14 16	15 15	59	
Breast Biopsy needle	19100	Nyreen	11 53	12 28	35	35
Breast Biopsy incisional	19101	Martindale	13 30	14 15	45	55
	19101	Ortenzo	15 21	16 15	54	
	19101	Martindale	12 28	12 55	27	
	19101	Smith	10 13	10 45	32	
	19101	Nyreen	11 40	13 35	115	
Mastectomy, lymph	19162	Dames	11 36	13 59	143	143
Mastectomy, complete	19180	Smith	14 47	15 50	63	49
	19180	Harris	14 51	15 25	34	
Mastectomy, radical	19240	Sinclair	8 8	10 40	152	152
Mastopexy	19316	Clift	12 6	15 25	199	199
Implant removal	20680	Basamania	12 24	12 40	16	16
Coronoidectomy	21070	Startzell	8 5	9 45	100	100
Osteoplasty	21200	Startzell	8 20	9 22	62	62
Osteotomy	21203	Startzell	8 7	9 14	67	83
	21203	Vorono	11 5	12 10	65	
	21203	Startzell	7 57	10 1	124	
	21203	Startzell	11 19	12 34	75	
Mandible Graft	21215	Startzell	13 28	15 20	112	112
Osteoplasty of maxilla	21250	Vorono	8 36	11 40	184	184
Osteoplasty w/bone graft	21254	Startzell	11 15	14 45	210	210
Malar fracture	21360	Startzell	10 55	11 39	44	87
	21360	Garth	12 59	15 50	171	
	21360	Rockwell	10 30	11 15	45	
Arthrodesis	22561	Peterson	8 30	15 9	399	399
Lumbar Spine Fusion	22720	Bacon	8 46	14 1	315	315
Clavicle Excision	23180	Johnstone	13 6	13 55	49	49
Humerus Excision	24110	Arciero	13 22	13 45	23	23
Tendon repair	24305	Arciero	7 57	9 40	103	103
Elbow Fracture	24825	Rockwell	7 58	8 35	37	37
Muscle repairs	25260	Johnstone	12 50	13 25	35	35
Scaphoid repair	25440	Arciero	13 28	14 20	52	52

APPENDIX O
SURGEON'S ACTIVITY PROFILE

APPENDIX O
SURGEON'S ACTIVITY PROFILE

PRIMARY SURGEON	OPERATION PERFORMED	SURGERY DATE	BEGIN SURGERY TIME	END SURGERY TIME	CASE TIME (MIN)	AVERAGE CASE TIME (MIN)
Spain	58120	85/8/28	15 35	16 05	30	30
Spain	59820	85/9/21	08 30	08 45	15	19
Spain	59820	85/8/28	17 08	17 30	22	
Startzell	21203	85/6/07	08 07	09 14	67	89
Startzell	21203	85/6/18	07 57	10 01	124	
Startzell	21203	85/6/18	11 19	12 34	75	
Startzell	21215	85/6/05	13 28	15 20	112	112
Startzell	21254	85/6/04	11 15	14 45	210	210
Startzell	21360	85/6/07	10 55	11 39	44	44
Startzell	41899	85/6/21	07 55	09 55	120	120
Stewart	59820	85/6/24	13 55	14 30	40	40
Stone	57520	85/9/05	15 01	15 35	34	34
Stone	58150	85/9/19	08 10	10 20	130	130
Stone	58720	85/7/25	08 25	10 50	145	145
Stone	58980	85/8/30	14 40	15 15	35	35
Sueoka	75653	85/6/27	11 00	11 54	54	54
Susini	23470	85/7/19	13 13	14 45	92	92
Susini	23515	85/7/17	10 59	12 45	106	106
Susini	26480	85/7/16	11 14	12 20	66	66
Susini	27041	85/7/30	11 07	13 50	163	163
Susini	27130	85/8/19	09 05	11 10	125	125
Susini	27373	85/7/09	07 56	08 23	27	27
Susini	27378	85/7/02	13 13	15 15	122	122
Susini	27506	85/7/05	10 10	15 30	320	320
Susini	28288	85/8/09	14 10	16 01	111	111
Susini	28292	85/8/09	10 50	12 20	90	90
Susini	28485	85/8/13	11 37	13 25	108	108
Susini	63010	85/7/26	12 59	19 01	360	360
Tabatzky	11402	85/8/07	08 39	10 08	91	91
Tabatzky	31032	85/6/07	08 05	08 35	30	58
Tabatzky	31032	85/8/30	13 45	15 10	85	
Tabatzky	31033	85/7/10	08 50	11 10	140	140
Tabatzky	31541	85/8/15	12 28	13 35	67	42
Tabatzky	31541	85/9/27	11 15	12 01	46	
Tabatzky	31541	85/7/24	08 36	08 50	14	
Tabatzky	38510	85/8/21	12 44	13 15	31	31
Tabatzky	41116	85/9/11	11 25	12 09	44	44
Vaccaro	51900	85/8/29	08 30	12 10	220	220
Vaccaro	55530	85/8/19	12 43	13 08	25	25
VanNorman	19101	85/7/09	14 25	15 35	70	70

APPENDIX P
OPERATING ROOM DAILY SCHEDULE

APPENDIX P
OPERATING ROOM DAILY SCHEDULE

OPERATING ROOM SCHEDULE					HOSPITAL			DATE		
					MADIGAN ARMY MEDICAL CENTER			19 September 1955		
TIME AND ROOM	PATIENT'S NAME, STATUS, AGE AND RELIGION	PATIENT'S REGISTER NUMBER (M/M/F) (P/M/F) (P/M/F)	NURSING UNIT FROM TO	OPERATION	SURGEONS	NURSING STAFF	ANESTHETIST	ANESTHETIC/ BLOOD (Unit)		
Room 1-1	Dep 09 Y	01- [REDACTED]	01	Revision of ventriculo-peritoneal shunt	Dr. [REDACTED] Dr. [REDACTED]		Dr. [REDACTED]	Choice		
Room 1-2	Ret 61 Y	20- [REDACTED]	07	Clipping of left internal carotid artery aneurysm	Dr. [REDACTED] Dr. [REDACTED] Dr. [REDACTED]			Choice		
Room 2-1	Dep 02 B	01- [REDACTED]	01	Repeat postero-medial release left foot	Dr. [REDACTED] Dr. [REDACTED]		Dr. [REDACTED]	Choice		
Room 2-2	Dep 13 P	04- [REDACTED]	01	Removal Steidlmann pins, left hip	Dr. [REDACTED] Dr. [REDACTED]			Choice		
Room 3-1	Dep 02 Y	[REDACTED]	01	Recess medial rectus recession, bilat	Dr. [REDACTED]		Dr. [REDACTED]	General		
Room 4-1	Dep 04 Y	01- [REDACTED]	01	Right inguinal exploration	Dr. [REDACTED] Dr. [REDACTED]		Dr. [REDACTED]	General		
Room 4-2	Ret 72 Y	20- [REDACTED]	05	Small-carrier pendle prosthesis	Dr. [REDACTED] Dr. [REDACTED]			Choice		
Room 4-3	AD 27 Y	20- [REDACTED]	05	Low ligation left spermatic vein	Dr. [REDACTED] Dr. [REDACTED]			Choice		
Room 5-1	Ret 56 P	20- [REDACTED]	05	Cordylar implant left trapezium	Dr. [REDACTED] Dr. [REDACTED]		Dr. [REDACTED]	Accessory blood		
Room 5-2	Ret 72 P	20- [REDACTED]	05	Right ankle fusion	Dr. [REDACTED] Dr. [REDACTED]			Choice		

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REPLACES DA FORM 1923

APPENDIX P CONTINUED

OPERATING ROOM SCHEDULE					HOSPITAL		MIDICAN ARMY MEDICAL CENTER			DATE	
TIME AND ROOM	PATIENT'S NAME, STATUS, AGE AND RELIGION	PATIENT'S REGISTER NUMBER & SSN (with Family Member Prefix)	NURSING UNIT FROM TO	OPERATION	SURGEONS	NURSING STAFF	ANESTHETIST	ANESTHETIC/ BLOOD (Unit)			
Room 6-1	[REDACTED] Dep 07 Y	12 [REDACTED]	01	Adenoidectomy	Dr. [REDACTED] Dr. [REDACTED]		CPT [REDACTED] LTC [REDACTED]	General			
Room 6-2	[REDACTED] Dep 11 Y	03 [REDACTED]	01	Caldwell-Luc left maxillary sinus	Dr. [REDACTED] Dr. [REDACTED]			General			
Room 6-3	[REDACTED] AD 23 Y	20 [REDACTED]	05	Tonsillectomy	Dr. [REDACTED] Dr. [REDACTED]			General			
Room 7-1	[REDACTED] Dep 37 Y	30 [REDACTED]	05	TAH	Dr. [REDACTED] Dr. [REDACTED]		CPT [REDACTED] CPT [REDACTED]	Choice			
Room 7-2	[REDACTED] Dep 34 M	30 [REDACTED]	05	TAH	Dr. [REDACTED] Dr. [REDACTED]			Choice			
Room 7-3	[REDACTED] AD 20 Y	28 [REDACTED]	05	Diagnostic Laparoscopy	Dr. [REDACTED] Dr. [REDACTED]			Choice			
Room B-1	[REDACTED] Dep 24 7	30 [REDACTED]	02	Primary C-Section	Dr. [REDACTED]		CPT [REDACTED] MAJ [REDACTED]	Choice			
Room T-1	[REDACTED] Dep 16 Y	01 [REDACTED]		Surgical removal of teeth 1,16,17,32	Dr. [REDACTED] Dr. [REDACTED]	MS [REDACTED] SP [REDACTED] MS [REDACTED] PV [REDACTED]	Dr. [REDACTED] Dr. [REDACTED]	2U General			
Room T-2	[REDACTED] Dep 20 Y	30 [REDACTED]		Surgical removal teeth 1,16,17,32	Dr. [REDACTED] Dr. [REDACTED]		Dr. [REDACTED] Dr. [REDACTED]	General			
Room T-3	[REDACTED] AD 25 Y	20 [REDACTED]		Surgical removal teeth 1,16,17,32	Dr. [REDACTED] Dr. [REDACTED]		Dr. [REDACTED] Dr. [REDACTED]	General			

DD FORM 1373

REPLACES DA FORM 1373, 1-67

DD FORM 1 SEP 73 1923

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